

Ronald N. Germain, M.D., Ph.D.

NIH Distinguished Investigator

Chief, Laboratory of Systems Biology (LSB)

Chief, Lymphocyte Biology Section, Laboratory of Systems Biology

Associate Director, Trans-NIH Center for Human Immunology (CHI)

National Institute of Allergy and Infectious Diseases, National Institutes of Health, DHHS

Office Ph: 301-496-1904

e mail: rgermain@nih.gov

<http://www3.niaid.nih.gov/labs/aboutlabs/li/lymphocyteBiologySection/germain.htm>

Biosketch

Dr. Ronald N. Germain received his M.D. and Ph.D. from Harvard University, the latter for research with B. Benacerraf, recipient of the 1980 Nobel Prize in Physiology and Medicine. Since that time, he has investigated basic T-cell immunobiology, first on the faculty of Harvard Medical School and, since 1982, as the Chief, Lymphocyte Biology Section in the Laboratory of Immunology and now as Chief of the new Laboratory of Systems Biology at the National Institute of Allergy and Infectious Diseases, National Institutes of Health. Over the years, he and his colleagues have made key contributions to our understanding of Major Histocompatibility Complex (MHC) class II molecule structure–function relationships, the cell biology of antigen processing, and the molecular basis of T cell recognition. More recently, his laboratory has been focused on the relationship between immune tissue organization and dynamic control of adaptive immunity at both the initiation and effector stages. Experiments at the whole cell, tissue, and organism level are being used to build a more complete picture of the operation of the immune system, including those utilizing novel dynamic *in situ* microscopic live animal imaging methods that his laboratory helped pioneer. Efforts are also underway to create computer models of immune system function based on these studies. Dr. Germain has published more than 300 scholarly research papers and reviews. Among numerous honors, he was elected as an Associate (foreign) member of EMBO (2008), awarded the Landsteiner Medal of the Austrian Society for Allerology and Immunology (2008), elected honorary member of the Scandinavian Society for Immunology, selected as a Distinguished Lecturer, American Association of Immunologists, 2006, designated an NIH Distinguished Investigator, elected a Fellow of the AAAS, and selected to deliver numerous named lectureships at major academic institutions in the US and abroad. He serves as an associate or advisory editor of the J Exp Med, Immunity, Current Biology, Mol Systems Biol, Int Immunol, BMC Biology, and Nature Scientific Reports, and has previously served as Deputy Editor of J Immunol and Editor, Immunity. He sits on several academic scientific advisory boards, helped co-found the Immunology Interest Group and Systems Biology Interest Group at NIH, and acts as Associate Director for the trans-NIH Center for Human Immunology.

CURRICULUM VITAE

Name: Dr. Ronald N. Germain

Education:

1970 Sc.B., Brown University, Providence, RI
1970 Sc.M., Brown University, Providence, RI
1976 Ph.D., Harvard University, Boston, MA
1976 M.D., Harvard University, Boston, MA

Brief Chronology of Employment:

1976-1977	Instructor, Pathology, Harvard Medical School and Intern in Pathology, Peter Bent Brigham Hospital
1977-1980	Assistant Professor, Pathology, Harvard Medical School
1980-1982	Associate Professor, Pathology, Harvard Medical School
1981-1982	Guest Investigator, Laboratory of Molecular Genetics, National Institute of Child Health and Human Development, NIH
1982-1987	Senior Investigator, Laboratory of Immunology, National Institute of Allergy and Infectious Diseases, NIH
1987-2011	Chief, Lymphocyte Biology Section, Laboratory of Immunology, National Institute of Allergy and Infectious Diseases, NIH
1989-2002	Senior Executive Service, DHHS
1994-2011	Deputy Chief, Laboratory of Immunology, National Institute of Allergy and Infectious Diseases, NIH
2006-2011	Director, Program in Systems Immunology and Infectious Disease Modeling, National Institute of Allergy and Infectious Diseases, NIH
2008-Date	Associate Director - Systems Biology and Technology, Trans-NIH Center for Human Immunology, Inflammation, and Autoimmunity [CHI]
2011-Date	Chief, Laboratory of Systems Biology, National Institute of Allergy and Infectious Diseases, NIH
2011-Date	Chief, Lymphocyte Biology Section, Laboratory of Systems Biology, National Institute of Allergy and Infectious Diseases, NIH

Honors:

Summa cum laude, Honors in Biology, Brown University, Sc.B.
Magna cum laude, Harvard Medical School, M.D.
Sigma Xi
Recipient of Milton Fund Award, 1977-1978
Recipient of American Cancer Society Scholar Grant, 1981-1982
Recipient of the NIH Directors Award, 1986
Recipient of the PHS Superior Service Award, 1989
Recipient of the DHHS Distinguished Service Award, 1994
Distinguished Lecturer of the German-American Academic Council, 1997
Recipient of the NIAID EEO Special Recognition Award, 1998
Recipient of the Meritorious Presidential Rank Award, Senior Executive Service, U.S.
Government, 2000
Benacerraf Lecturer, Dana-Farber Cancer Center, Harvard Medical School, 2002
Ernst Schering Foundation Lecturer, 2004

Ronald N. Germain, M.D., Ph.D.

Distinguished Lecturer in Immunology, Children's Hospital Research Foundation, Cincinnati, 2004
Distinguished Lecturer, American Association of Immunologists, 2006
R.G.E. Murray Lecturer, Univ. of Western Ontario, 2006
Australasian Society for Immunology (ASI) Visiting Lecturer, 2007
Landsteiner Medal, Austrian Soc. Allerology and Immunology, 2008
Leukemia Fund Research Lecturer, Cambridge University, Cambridge, UK, 2008
Elected Foreign Associate, EMBO, 2008
Blumenthal Lecturer, Univ. of Minnesota, 2009
Willison Lecturer, Univ. of Michigan, 2009
Merck Serono Lecturer, European Society of Dermatological Research, Budapest, 2009
Ita Askonas Lecturer, Imperial College, London UK, 2010
NIAID Merit Award, 2010
NIH Director's Merit Award, 2010
Sidney Leskowitz Memorial Lecturer, Tufts University, Boston, MA 2011
Scandinavian Foundation for Immunology Lecturer, Geilo, Norway 2011
Mayberry Lecturer, Northwestern University School of Medicine, 2011
Mary Lou Clements-Mann Memorial Lecturer in Vaccine Sciences, National Foundation for Infectious Diseases, 2011
Ralph Wedgwood Lecturer, World Immunology Conference, New York, NY 2011
NIH Distinguished Investigator, 2011
Richard Akeson Memorial Lecturer, Cincinnati Children's Hospital Research Foundation, 2011
Ishizaka Lecturer, La Jolla Institute for Allergy and Immunology, 2011
Elected honorary member, Scandinavian Society for Immunology, 2011
Elected member, European Academy of Tumor Immunology, 2011
Koshland Lecturer, University of Chicago, 2012
Elected AAAS Fellow, 2012

Editorial Boards; Study Sections; Committees:

1980-1984	Associate Editor, The Journal of Immunology
1980-1984	Associate Editor, The Journal of the Reticuloendothelial Society
1981-1983	Associate Editor, The Journal of Molecular and Cellular Immunology
1984-1989	Advisory Editor, Annales de L'Institut Pasteur
1985-1987	Member, Advisory Committee on Clinical Investigations I - Immunology and Immunotherapy, American Cancer Society
1987-1988	Member, Clinical Review Subpanel, NIAID, NIH
1987-1992	Deputy Editor - Journal of Immunology
1988	Organizer, 6th International H-2/HLA Cloning Workshop
1990-1993	Organizer and Chairperson, NIAID Research Grand Rounds
1991-1992	American Association of Immunologists Membership Committee
1991-2000	Member, Scientific Advisory Board, Ruggero Ceppellini Advanced School of Immunology, Naples, Italy
1992-1994	Chairman, American Association of Immunologists Membership Committee
1992-Date	Advisory Editor, Journal of Experimental Medicine
1994-2003	Associate Editor, Immunity
1994-1998	Promotion and Tenure Committee, NIAID, NIH
1994	Member, NIAID STD Human Challenge Study Advisory Group
1994	Participant, OAR Planning Meeting, Vaccine Subcommittee

Ronald N. Germain, M.D., Ph.D.

1995	Member, Search Committee, NIA Scientific Director
1995-1996	Member, NIH AIDS Targeted Antiviral Review Panel
1995-1999	Scientific Review Board, Howard Hughes Medical Institute
1995-Date	Editorial Board, Scandinavian Journal of Immunology
1995-1997	Founding member, NIH Immunology Interest Group Organizing Committee
1996-1999	Member, American Association of Immunologists Education Committee
1996	Member, NIAID Tuberculosis Program Review Panel
1996	Ad hoc member, IOM Malaria Vaccine Evaluation Group
1996-2000	Member, Etiology and Pathogenesis Planning Subcommittee, OAR
1996-1997	Chair, NIAID Committee on Transgenic and Gene Targeting Technology
1997-Date	Editorial board, Current Biology
1997	Member, NIAID Central Microscopy Facility Planning Committee
1997	Member, NEI Retinal Disease Panel, 5 year Planning Committee
1997-1999	Member, Steering Committee, Vaccine Research Center, NIH
1997-1999	Member, Association of Immunologists Nominations Committee
1999	Chair, NIAMS Promotion and Tenure Committee
1999-2000	Member, VRC Immunology Search Committee
2000-2003	HHMI-NIH Research Scholars Program Advisory Committee
2000-2004	Member, Scientific Evaluation Panel, Immune Tolerance Network
2000-Date	Member, Advisory Committee, NIAID Research Technology Branch
2000-Date	Member, NIAID Confocal Microscopy Users Committee
2001-Date	Immunology advisor, BioMedCentral Immunology
2001	Co-organizer, R. Ceppellini Advanced School of Immunology course "Remembering Environmental Experiences: The Physiological Basis of Memory in the Immune and Nervous Systems," Capo Miseno, Italy
2003-2006	Editor, Immunity
2003	Co-organizer, NIH Systems Biology Interest Group Symposium on "Systems Biology," Airlie House, Warrenton, VA
2005	Co-organizer, HHMI conference on Intravital Imaging of the Immune System
2005	Co-organizer, 2 nd international meeting on "Dendritic Cells at the Host-Pathogen Interface," Airlie House, Warrenton, VA
2005-2007	Member, NIH Immunology Interest Group Steering Committee
2006-Date	Editorial Board, Immunity
2006	Co-chair, Trans-NIH Working Group Research Initiatives
2007-2008	Member, Trans-NIH implementation Committee on Systems Biology Initiative, Committee on Inflammation and Autoimmunity Translational Initiative, Committee on Imaging Initiative
2006-2007	Co-Chair, NIH Immunology Interest Group Steering Committee
2007-2009	Editorial Board member, Journal of Clinical Investigation
2007-2011	Editorial Board, Interdisciplinary Reviews Systems Biology and Medicine
2007	Co-organizer of first Keystone Symposium on "Imaging Immune Responses"
2007	Chair and Plenary Speaker, NIH Research Festival Symposium on "Immune Cell Dynamics: From Monkeys to Models to Movies"
2008	Intramural scientist representative, Science of Science management meeting, OPASI, NIH
2008-date	Editorial Board, Journal of Biology (now BMC Biology)
2008	Member of the International Program Committee, 14 th International Congress of Immunology, ICI 2010
2008	Invited participant, Science of Science Workshop, Office of Science and

Ronald N. Germain, M.D., Ph.D.

2008-Date	Technology Policy [Office of the President], GW University, Washington, DC Collaborative Professor, World Premiere Initiative (WPI) Immunology Frontier Research Center of Osaka University
2009	Search Committee, LMIV, NIAID
2009-Date	Editorial board member, International Immunology
2009	NIH Computing Power Committee member
2009	Invited participant, Novartis analysis of adjuvant safety
2009	Invited participant, NIH presentation to Sage on large scale datasets and modeling
2009	Member, Trans-NIH Systems Biology faculty search committee
2009-2011	Member, Global AIDS Vaccine Enterprise Strategic Planning Committee, Working Group 3 (Novel Approaches including Systems Biology)
2009	Member, Search Committee, Senior Scientist, LMIV
2009	Member, Search Committee, Laboratory of Immunology PI recruit
2009	Dean's Committee on Quadrangle Basic Science Reorganization at Harvard Medical School
2009-date	Advisory editorial board member, Molecular Systems Biology
2009-date	Member, RCAI RIKEN (Yokohama, Japan) systems biology advisory review board
2009-date	Member, NIAID Bioinformatics Working Group
2009-2011	Member, Trans-NIH systems biology principal investigator search committee
2010-2013	Member of the International Program Committee, 15 th International Congress of Immunology, ICI 2013
2010-date	Member, Editorial Advisory Panel, Scientific Reports
2010-date	Ex officio member and CHI representative, NIAID HIPC Steering Committee
2011	Co-organizer, CHI Symposium "Advanced Technologies in Human Immunology Research"
2011	CHI representative, FITMaN FOCIS working group on flow cytometry in human immunology studies
2012-date	Co-chair, Molecular and Cellular Immunology Advisory Board, R. Ceppellini School of Immunology

Ronald N. Germain, M.D., Ph.D.

Lectures by Invitation (2008 – date; abbreviated)

1. June 9 – 11, 2008 – “Systems Biology White Paper,” Symposia Organizzazione Congressi Srl, Portofino, Italy
2. June 15 – 17, 2008 – “New Tools for Multiscale, Spatially-resolved Modeling and Simulation: A Focus on Biology, Not the Math,” Center for Infectious Disease Dynamics, State College, PA
3. June 18 – 21, 2008 – “Modeling and Simulation of Immunological Systems: Replacing the Old Ways with the New,” Summer Symposium in Molecular Biology, State College, PA
4. July 16, 2008 – “Developing a Multiscale View of Immune Function by Integrating Molecular Studies, Movies, and Mathematical Models,” Harvard Medical School, Boston, MA
5. August 18 – 22, 2008 – “Meeting and Greeting: Dynamic Intravital Imaging of Immune Cell Behavior,” Immunobiology and Immunochemistry Conference, Gordon Research Conference, Oxford, United Kingdom
6. Sept. 4, 2008 – “Deciphering TCR Ligand Discrimination by Combining Experiments, Computer Modeling, and Predictive Simulation” and “The In Situ Dynamics of Innate and Adaptive Immune Cell behavior Revealed by Intravital Multiphoton Microscopy,” Joint Annual Meeting of the Austrian and German Immunological Societies, Vienna, Austria
7. Sept. 25, 2008 – “Dynamic 2 Photon Intravital Imaging of Immune Cell Migration, Interaction, and Function,” Cambridge Immunology Forum “Visions of Immunology,” Cambridge University, Cambridge, UK
8. Sept. 29, 2008 – “Developing an Integrated Vision of Immune Function by Combining Molecular Studies, Modeling, and Movies,” Univ. of Tokushima, Tokushima, Japan
9. Oct. 1, 2008 – “Immune Cell Migration, Territoriality, Interaction, and Function Assessed by Intravital 2-Photon Microscopy,” 10th International Symposium on Dendritic Cells, Kobe, Japan
10. Oct. 6, 2008 – “Omic-scale Analyses and Multiscale Computational Modeling as New Discovery Tools in Disease Research,” Lupus Research Institute, New York, NY
11. Oct. 8 – 10, 2008 – “Combining Molecular Studies, Models, and Movies to Develop an Integrated View of Immune Function,” 3rd B. Halpern Symposium, Paris, France
12. Nov. 18-19, 2008 – “Lymphocyte Migration, Territoriality, Interaction, and Function Assessed by Intravital 2-photon Microscopy,” British Society for Immunology, Glasgow, Scotland
13. Nov. 20, 2008 – “Developing an Integrated Systems Understanding of Immune Function by Combining Molecular Studies, Modeling, and In Situ Movies,” Institute of Immunology and Infection Research, University of Edinburgh, Edinburgh, Scotland
14. Jan. 5, 2009 – “Dynamic Intravital Imaging of Immune Cell Function,” Baylor Institute for Immunological Research, Dallas, TX

Ronald N. Germain, M.D., Ph.D.

15. Jan. 17, 2009 – “Towards an Integrated View of Immune Function Combining Molecular Studies, Models, and Movies,” EMBO meeting on ‘Visualizing Immune System Complexity,’ Marseilles, France
16. Jan. 27, 2009 – “Dynamic Intravital Imaging of Immune Cell Migration, Interaction, and Effector Function,” Midwinter Conference of Immunologists, Asilomar, CA
17. Jan. 28, 2009 – “A Systems Biology Approach to Immune Analysis,” AVRS meeting on Systems Biology and HIV Vaccines, Bethesda, MD
18. Feb. 27, 2009 – “Visualizing the Cell-Cell Interactions Underlying Humoral Immune Responses,” Keystone Symposium ‘B Cells in Context,’ Taos, NM
19. March 13, 2009 – “Immune Cells on the Move,” AAAAI Annual Meeting, Washington, DC
20. March 19, 2009 – “Dynamic High Resolution Intravital Imaging: New Insights into Immune Cell Behavior and Host-Pathogen Relationships Through Direct Observation In Situ,” Opening Lecture, Joint Meeting of the Swiss Society for Allerology and Immunology/Swiss Society for Infectious Diseases, Geneva, Switzerland
21. April 3, 2009 – "Enhancing Our Understanding of Immune System Function Through Dynamic In Vivo Imaging and In Silico Modeling." Blumenthal Lecture, University of Minnesota, Minneapolis, Minnesota.
22. April 9, 2009 – "Integrating Molecular Studies, Models, and Movies into a Dynamic Multiscale View of the Immune System." Willison Lecture, University of Michigan, Ann Arbor, Michigan.
23. April 13 – 16, 2009 – "Lymphocyte Migration, Territoriality, Interaction, and Function Assessed by Intravital 2-photon Microscopy." Imaging the Immune System from Cancer to Pathogens, British Society for Immunology, York, United Kingdom.
24. May 3 – 5, 2009 – "Dynamic In Situ Imaging of Immune Cell Behavior: New Insights into the Origin of XLP and the Role of SAP in Controlling Productive T Cell – B Cell Interactions." Children's Hospital Primary Immunodeficiency Diseases Center 2nd symposium, Children's Hospital, Boston, Massachusetts.
25. May 23 - 28, 2009 – “Structures, Signals and Cell interactions Involved in Adaptive Immune Responses as Revealed by Dynamic Intravital Imaging.” First Kishimoto Symposium on Paradigms of Immune Regulation, Osaka, Japan.
26. July 4 - 8, 2009 – “Structures, Signals and Cell interactions Involved in Adaptive Immune Responses as Revealed by Dynamic Intravital Imaging.” 16 Germinal Center Conference, Frankfurt, Germany.
27. July 9, 2009 – “A Predictive Understanding of Immune Function Derived from Molecular, Studies, Models, and Movies.” Max Planck Institute for Immunobiology, Freiburg, Germany
28. Sept. 11, 2009 – “The Role of Cell Dynamics in Immune System Function: Insights from High-resolution Intravital Imaging of Lymphoid and Peripheral Tissue Sites.” Merck Serono Lecture, European Society for Dermatological Research, Budapest, Hungary

Ronald N. Germain, M.D., Ph.D.

29. Sept. 14, 2009 - "In Situ Dynamics of T Cell Co-operation and Effector Activation Analyzed By 2 Photon Microscopy." EMBO meeting on signaling in the Immune System, Siena, Italy
30. Sept. 17, 2009 – “Combining Molecular Studies, Dynamic Intravital Imaging, and Multiscale Computational Modeling to Achieve a Predictive Understanding of In Vivo Immune Responses.” Novartis Vaccines and Diagnostics, Siena, Italy
31. Oct. 1, 2009 – “Dynamic intravital imaging of the immune system.” Frontiers in Basic Immunology, NCI, NIH, Bethesda, MD
32. Oct. 7, 2009 – “Enhancing Our Understanding of Human Immunity by Integrating Emerging High-density Analytic Technologies and Computational Systems Methods.” NIH Research Festival Symposium on Human Immunology, Bethesda, MD
33. Oct. 9, 2009 – “Immune Cell Migration, Territoriality, Interaction, and Function Assessed by Intravital 2-Photon Microscopy.” NCI Immunology and Inflammation Seminar Series, Frederick, MD
34. Oct. 21, 2009 – “In Vivo Dynamics of the Immune Response as Revealed by Multiphoton Imaging.” AIDS Vaccine 2009, Paris, France
35. Oct. 24, 2009 – “Understanding the Inner Workings of the Immune System: From Images to Immunological Models.” Harvard Medical School Immunology Retreat, Lincoln, NH
36. November 16, 2009 - "Overview of the Trans-NIH Center for Human Immunology," American Association of Immunologists, Bethesda, MD
37. November 18, 2009 - "Systems Biology of Host-Pathogen Interactions," Systems Biology Workshop, Chemical and Biological Defense Science and Technology Conference, Dallas, TX
38. December 9, 2009 - "An Integrated Computational Systems Biology Program: Developing the Tools Biologists Need for Modeling and Simulation in Health and Disease," Systems Biology of Human Aging, National Institute on Aging, Baltimore, MD
39. December 17, 2009 - "Dynamic In Vivo High Resolution Imaging of Adaptive and Innate Immune Cell Behavior in Lymphoid and Peripheral Tissues," Thaler Lecture, Aeras Global TB Vaccine Foundation, Rockville, MD
40. January 28, 2010 - "Developing an Integrate, Multiscale Picture of the Immune System Using Molecular Analysis, Dynamic Imaging, and Computational Biology," Immunobiology Seminar Series, Yale University, New Haven, CT
41. February 27 - March 4, 2010 - "Cell Dynamics during the Initiation and Effector Phases of Adaptive Immune Responses," Lymphocyte Activation and Gene Expression Keystone Meeting, Keystone, CO
42. March 21 - 26, 2010 - "Intravital Imaging of Adaptive Immune Effector Activity," HIV Vaccine Keystone Meeting, Banff, Canada

Ronald N. Germain, M.D., Ph.D.

43. April 5 - 9, 2010 - "Dynamic Intravital Imaging of the Immune System" and "A New Biologist-centric Approach to Computational Modeling and Simulation of Immunity," Lautenberg Center retreat, Tiberias, Israel
44. April 10 - 12, 2010 - "Exploring the immune System Using Movie-making and Computational Modeling," Weizmann Institute, Rehovot, Israel
45. April 14 - 17, 2010 - "Dynamic Visualization of Immune System Function Using Intravital 2-Photon Microscopy: A First-Hand View of Immunity In Situ," Ben-Guirot University, Beer-Sheva, Israel
46. May 8, 2010 – “In Vivo Cell Dynamics,” IMMUNOLOGY 2010, Baltimore, MD
47. May 16 - 21, 2010 - "Dynamic Intravital Imaging of Immune Cell Behavior in Lymphoid and Peripheral Tissues," Immunochemistry and Immunobiology Gordon Research Conference, Les Diablerets, Switzerland
48. June 1 - 4, 2010 - "Dynamic In Situ Visualization of Immune System Interactions with Pathogens Using Intravital 2-photon Microscopy," EMBO, Nice, France
49. June 20 - 24, 2010 - "Imaging and Modeling the Immune System at Work," Systems Biology and Immune Responses, Fondation Merieux, Annecy, France
50. June 28, 2010 - "Dynamic Intravital Imaging of the Immune System - Replacing Cartoons with Movies of the Real Thing," AAI Introductory Course, Philadelphia, PA
51. July 26-27, 2010 - "An Integrated Multiscale Systems Approach to Analysis of Immune Function: From Molecules to Movies to Human Biology, University of Washington Systems Biology Speaker Series, Seattle, WA
52. August 5, 2010 – “Dynamic Intravital Imaging of the Immune System,” Rocky Mountain Labs, NIAID, Hamilton, MT
53. August 22 - 28, 2010 - "In Situ Dynamics of T Cell Co-operation and Effector Activation Analyzed By 2-Photon Microscopy," 14th International Congress of Immunology, Osaka-Kobe, Japan
54. Sept. 16, 2010 – "Visualizing and Modeling the Immune System: An Integrated Approach to Understanding Host Defense," Imperial College, London, UK
55. Sept. 17, 2010 – "Dynamic Intravital Imaging of Immune Cell Activation and Effector Function in Lymphoid Tissues and Peripheral Sites," Cancer Research UK, London, UK
56. Oct. 7, 2010 – “Probing the Initiation and Effector Phases of T-Cell Responses Using Dynamic Intravital Microscopy,” Cancer Research Institute Symposium, New York, NY
57. Oct. 16, 2010 - "Probing Central and Peripheral Immune Function Using Dynamic Intravital 2-Photon Imaging," 3rd International Symposium “Adaptive Immunity”,

Ronald N. Germain, M.D., Ph.D.

Erlangen, Germany

58. Oct. 28, 2010 – “A Systems Approach to Immunology,” Keystone / Gates Symposium on Immune Mechanisms of Vaccination, Seattle, WA
59. Nov. 9, 2010 – “Immune System Function: Molecules, Models, Mice, Movies, and (Hu)man,” IMP Seminar Series, Emory University, Atlanta, GA
60. Dec. 1, 2010 – “Dynamic Intravital Imaging of the Immune System,” 16th Takeda Science Foundation Symposium on Bioscience, Tokyo, Japan
61. Dec. 4, 2010 – “A Systems Biology Approach to the Study of Human Immunity: Defining the Normal Immunome and Its Perturbation by Influenza Vaccination,” Cell Symposia on Influenza: Translating Basic Insights, Washington, D.C.
62. Jan. 18, 2011 – “Dynamic In Situ Visualization of Immune System Interactions with Pathogens Using Intravital 2-photon Microscopy,” Tuberculosis: Immunology, Cell Biology and Novel Vaccination Strategies, Vancouver, Canada
63. Jan. 31, 2011 – “Combining Cell Biology, Computation, and Cinematography in an Integrated Approach to Understanding the Immune System,” Immunology Program Seminar Series, Washington University, St. Louis, MO
64. Feb. 16 and 17, 2011 – “Multiscale Systems Analysis and Modeling of Immune Recognition and the Host Response to Infection,” and “Dynamic Intravital Imaging of the Initiation and Effector Limbs of the Immune System,” Genentech, South San Francisco, CA
65. March 9, 2011 – “Developing a Systems-level Understanding of Immune Function Through Molecular Studies, Moviemaking, and Modeling,” Leskowitz Lecture, Tufts University, Boston, MA
66. March 20 – 25, 2011 – “Systems Immunology and Modeling of Host-Pathogen Interactions in Infectious Disease,” Chemical and Biological Terrorism Gordon Research Conference, Ventura, CA
67. April 4 – 7, 2011 – “Immunological Basis of Vaccines,” (Student lecture) and “Revealing the In Situ Functioning of the Immune System Through Dynamic Intravital Imaging,” (Keynote address), Scandinavian Society of Immunology 40th meeting, Oslo, Norway
68. April 7 – 11, 2011 – “Systems Immunology,” Advances in Targeted Therapies, Dubrovnik, Czech Republic
69. April 15, 2011 – “Combining Observation and Computation in a Multiplex Approach to Understanding System Physiology,” Commitment to Lineage, Boston, MD
70. May 12, 2011 – “Attaining an Integrated Systems-level View of Immunity Using Computational Modeling, Imaging, and Informatics,” Mayberry Lecture, Northwestern, Chicago, IL
71. May 17, 2011 – “Dynamic In Vivo Visualization of the Initiation and Effector Limbs of Adaptive Immune Response,” Mary Lou Clements-Mann Memorial Lecture in Vaccine Sciences, 14th

Ronald N. Germain, M.D., Ph.D.

Annual Conference on Vaccine Research, Baltimore, MD

72. May 18 – 19, 2011 Symposium on Intravital Microscopy, NIH
73. May 22- 28, 2011 – “A Systems Approach to Influenza Infection and Vaccine Responses,” Pathogenesis of Influenza, Keystone Symposium, Hong Kong
74. June 1 – 5, 2011 – “Visualizing the Immune System in Action Using Dynamic Intravital Imaging,” Ralph Wedgwood Lecture, World Immunology Conference, New York, NY
75. June 8, 2011 – Defining Innate Immune Responses Meeting, Bethesda, MD
76. June 27 – 28, 2011 – “Integrating Molecular Studies, Moviemaking, and Modeling to Produce a Multiscale Systems View of Immunity,” Pharma Research and Early Development Organization Meeting, Roche, Nutley, NJ
77. July 11, 2011 - “Dynamic Intravital Imaging of the Immune System – Replacing Cartoons with Movies of the Real Thing,” AAI Introductory Course, University of Pennsylvania, Philadelphia, PA
78. September 9, 2011 – “Developing an Integrated View of the Immune System Using Moviemaking and Modeling,” Ishizaki Lecture, La Jolla Institute, La Jolla, CA
79. September 20, 2011 – “Developing an Integrated View of the Immune System Using Moviemaking and Modeling,” Akeson Memorial Lecture, Cincinnati Children’s Hospital, Cincinnati, OH
80. September 22 – 23, 2011 – “Using Molecular Studies, Modeling, and Moviemaking to Develop an Integrated View of the Immune System,” International Symposium, Collaborative Research Center, Magdeburg, Germany
81. October 9 – 12, 2011 – “Bottom-up and Top-down Systems Biology Approaches to Understand Immunity,” 9th Joint Meeting of the ICS-ISICR, Florence, Italy
82. October 17 – 20, 2011 – “Combining Molecular Studies, Modeling, and In Vivo Movies to Develop an Integrated Understanding of Immunity,” Immuno FOZ 2011, Iguacu, Brazil
83. October 27 – 29, 2011 – “Illuminating the Inner Workings of the Immune System Using Dynamic Intravital Imaging,” Advances in Immunity and Inflammation meeting, Gairdner Foundation, Toronto, Canada
84. November 28 – December 3, 2011 – “Multiscale Systems Immunology: From Fine-grained Modeling of Signaling Pathways to Bioinformatic Analysis of the Human Immunome,” Frontiers in Systems Biology Meeting, Croucher Advanced Study Institute, Hong Kong
85. January 9, 2012 – “Combining Intravital Imaging and Systems Biology to Better Understand Immune Function and Host-Pathogen Interactions,” Excellence in Genetics an Immunology Lecture Series, McGill University, Montreal, Canada
86. January 18-21, 2012 - “Dynamic Intravital Imaging of Immune Effector Responses to Infectious

Ronald N. Germain, M.D., Ph.D.

Agents,” Leibnitz Center Symposium ‘Imaging Infection 2012’, Hamburg, Germany

87. January 23, 2012 – “A New Omics: System-Wide Analysis of the Human Immune System in Health and Disease,” Rheumatoid Arthritis Keystone Symposium, Santa Fe, NM
88. March 2, 2012 – “Dynamic Intravital Imaging of the Inductive and Effector Phases of Immunity,” Ragon Imaging Symposium ‘From Animals to Atoms’, Harvard Medical School, Boston, MA
89. March 11 – 15, 2012 – “Imaging Immune Responses in Vivo” Regulation of Lymphocyte Signaling Meeting, Keystone Symposia, Keystone, CO
90. March 18 – 21, 2012 – “Systems Immunology – From Cells, to Mice, to Humans” Expert Panel, Roche, Basel, Switzerland
91. March 28 – April 1, 2012 – “Developing a Deeper Understanding of Immun Responses Using Systems Biology Approaches,” and “Gaining Insight into Inflammation and Immunity Using Advanced Dynamic and Static Imaging Technologies”, Advances in Targeted Therapies Meeting, Baveno, Italy
92. April 24 – 28, 2012 – “Dynamic Intravital Imaging of Innate and Adaptive Immunity” Cold Spring Harbor meeting on Gene Expression and Signaling, Cold Spring Harbor Labs, Cold Spring Harbor, NY
93. May 8, 2012 – “Systems Immunology – From Cells to Animal Models to the Clinic”, Harvard Medical School Immunology Symposium, Boston, MA
94. May 12 – 16, 2012 – “Dynamic Intravital Imaging” and “Systems Immunology: From Mice to Humans”, Turku Centre for Biotechnology, Turku, Finland
95. May 22 – 23, 2012 – “Using Advanced Imaging and Systems Biology to Understand Immunity” IFReC Dynamism of Immune Reactions and Regulation Symposium, Osaka, Japan
96. May 29 – June 3, 2012 – “Visualizing the Inner Workings of the Immune System Including the Response to Cell Death”, Death, Danger, Inflammation, and Immunity Conference, Pasteur Institute, Paris, France
97. June 3 – 5, 2012 – “Multiscale Analysis of the Immune System: Combining Systems Analysis and Dynamic Imaging to Gain a Deeper Understanding of Host-Defense” INSERM, Paris, France
- 98.. June 6 – 8, 2012 – “Multiscale Analysis of the Immune System: Combining Systems Analysis and Dynamic Imaging to Gain a Deeper Understanding of Host-Defense”, Centre d’Immunologie de Marseille-Luminy, Marseille, France
99. June 11, 2012 – “The Immune System in Action: Insights into Host Defense from Dynamic Intravital Imaging and Systems Biology,” Koshland lecture, University of Chicago, Chicago IL

Ronald N. Germain, M.D., Ph.D.

100. June 13, 2012 – “How Tissue Architecture and Cell Dynamics Inform Function in the Immune System: Insights from Multimodal Imaging”, Benacerraf Symposium, Harvard Medical School, Boston, MA
101. July 16, 2012 – “Dynamic Intravital Imaging of the Immune System”, AAI Introductory Course, University of Pennsylvania, Philadelphia, PA
102. August 18, 2012 – “Using Systems Biology to Understand Influenza Pathogenesis and Human Vaccine Responses”, Merck & Co, Philadelphia, PA
103. August 18-21, 2012 – “Using Highly Multiplexed Data Collection and Computational Biology to Probe the Human Immune System”, Cell Symposia on Human Immunity, Lisbon, Portugal
104. Sept. 21, 2012 - "Using Advanced Static and Dynamic Imaging to Understand Spatiotemporal Aspects of Immune System Organization and Function", MedImmune, Gaithersburg, MD
105. Oct. 9, 2012 – “Fantastic Voyage Rebooted: A visual journey into the dynamic life of the immune system”. NIH Research Festival Opening Session Plenary Lecture, Bethesda, MD

BIBLIOGRAPHY

1. Marchalonis, J.J., and Germain, R.N.: Tolerance to a protein antigen in a poikilotherm, the marine toad, *bufo marinus*. *Nature* 231: 321-322, 1971.
2. Gill, T.J., III, Enderle, J., Germain, R.N., and Ladoulis, C.T.: Genetic and cellular factors in the immune response. III. The cellular response to poly Glu⁵² Lys³³ Tyr¹⁵ in the highly responding ACI and poorly responding F344 strains of inbred mice. *J. Immunol.* 106: 1117-1118, 1971.
3. Williams, R.M., Germain, R.N., and Benacerraf, B.: Specific and nonspecific antitumor immunity. I. Description of an in vitro assay based on inhibition of DNA synthesis in tumor cells. *J. Natl. Cancer Inst.* 54: 697-708, 1975.
4. Germain, R.N., Williams, R.M., and Benacerraf, B.: Specific and nonspecific antitumor immunity. II. Macrophage- mediated nonspecific effector activity induced by BCG and similar agents. *J. Natl. Cancer Inst.* 54: 709-720, 1975.
5. Germain, R.N., Dorf, M.E., and Benacerraf, B.: Inhibition of T lymphocyte-mediated tumor specific lysis by alloantisera directed against the H-2 serological specificities of the tumor. *J. Exp. Med.* 142: 1023-1028, 1975.
6. Burakoff, S.J., Germain, R.N., Dorf, M.E., and Benacerraf, B.: Inhibition of cell-mediated cytolysis of trinitrophenyl derivatized target cells by alloantisera directed to the products of the K and D loci of the H-2 complex. *Proc. Natl. Acad. Sci.* 73: 625-629, 1976.
7. Germain, R.N., Williams, R.M., and Benacerraf, B.: Specific and nonspecific antitumor immunity. III. Specific T lymphocyte-mediated cytolysis of P815 mastocytoma and SL2 lymphoma by draining lymph node cells from syngeneic tumor-bearing DBA/2J mice. *Am. J. Path.* 85: 661-673, 1976.
8. Burakoff, S.J., Germain, R.N., and Benacerraf, B.: Cross-reactive lysis of trinitrophenyl (TNP)-derivatized H-2 incompatible target cells by cytolytic T lymphocytes generated against syngeneic TNP spleen cells. *J. Exp. Med.* 144: 1609-1620, 1976.
9. Lemonnier, F., Burakoff, S.J., Germain, R.N., and Benacerraf, B.: Cytolytic thymus-derived lymphocytes specific for allogeneic stimulator cells crossreact with chemically modified syngeneic cells. *Proc. Natl. Acad. Sci. USA* 74: 1229-1233, 1977.
10. Theze, J., Waltenbaugh, C., Germain, R.N., and Benacerraf, B.: Immunosuppressive factor(s) specific for L-glutamic acid⁵⁰-L-tyrosine⁵⁰ (GT). IV. In vitro activity and immunochemical properties. *Eur. J. Immunol.* 7: 705-710, 1977.
11. Pierres, M., Germain, R.N., Dorf, M.E., and Benacerraf, B.: Potentiation of a primary *in vivo* antibody response by alloantisera against gene products of the I region of the H-2 complex. *Proc. Natl. Acad. Sci. USA* 74: 3975-3979, 1977.
12. Benacerraf, B., and Germain, R.N.: The immune response genes of the major histocompatibility

Ronald N. Germain, M.D., Ph.D.

- complex. *Immunol. Rev.* 38: 70-119, 1978.
13. Pierce, C.W., Germain, R.N., Kapp, J.A., and Benacerraf, B.: Secondary antibody responses in vitro to L-glutamic acid⁶⁰-L-alanine³⁰-L-tyrosine¹⁰ (GAT) by (responder x nonresponder)F₁ spleen cells stimulated by parental GAT-macrophages. *J. Exp. Med.* 146:1827-1832, 1977.
 14. Germain, R.N., Theze, J., Kapp, J.A., and Benacerraf, B.: Antigen-specific T-cell-mediated suppression. I. Induction of L-glutamic acid-L-alanine-L-tyrosine specific suppressor T cells in vitro requires both antigen-specific T-cell-suppressor factor and antigen. *J. Exp. Med.* 147: 123-136, 1978.
 15. Sugimoto, M., Germain, R.N., Chedid, L., and Benacerraf, B.: Enhancement of carrier-specific helper T cell function by the synthetic adjuvant, N-acetyl muramyl-L-alanyl-D-isoglutamine (MDP). *J. Immunol.* 120: 980-982, 1978.
 16. Pierres, M., Germain, R.N., Dorf, M.E., and Benacerraf, B.: In vivo effects of anti-Ia alloantisera. I. Elimination of specific suppression by in vivo administration of antisera specific for I-J controlled determinants. *J. Exp. Med.* 147: 656-666, 1978.
 17. Germain, R.N., Theze, J., Waltenbaugh, C., Dorf, M.E., and Benacerraf, B.: Antigen specific T-cell mediated suppression. II. in vitro induction by I-J coded L-Glutamic acid⁵⁰-L-Tyrosine⁵⁰ (GT)-specific T cell suppressor factor (GT-TsF) of suppressor T cells (Ts₂) bearing distinct I-J determinants. *J. Immunol.* 121: 602-607, 1978.
 18. Germain, R.N., and Benacerraf, B.: Antigen-specific T cell-mediated suppression. III. Induction of antigen-specific suppressor T cells (Ts₂) in L-glutamic acid⁶⁰-L-alanine³⁰-L-tyrosine¹⁰ (GAT) responder mice by nonresponder-derived GAT-suppressor factor (GAT-TsF). *J. Immunol.* 121: 608-612, 1978.
 19. Pierres, M., and Germain, R.N.: Antigen-specific T cell-mediated suppression. IV. Role of macrophages in generation of L-glutamic acid⁶⁰-L-alanine³⁰-L-tyrosine¹⁰ (GAT)-specific suppressor T cells in responder mouse strains. *J. Immunol.* 121: 1306-1314, 1978.
 20. Germain, R.N., and Benacerraf, B.: The involvement of suppressor T cells in Ir gene regulation of secondary antibody responses of primed (responder x nonresponder)F₁ mice to macrophage-bound L-glutamic acid⁶⁰-L-alanine³⁰-L-tyrosine¹⁰. *J. Exp. Med.* 148: 1324-1329, 1978.
 21. Benacerraf, B., and Germain, R.N.: Specific suppressor responses to antigen under I region control. *Fed. Proc.* 38: 2053-2057, 1979.
 22. Benacerraf, B., and Germain, R.N.: Genetic control of the immune response. In: *Serano Symposium on the Immune System: Function and Dysfunction*. Doria (ed.). 1979.
 23. Germain, R.N., Ju, S-T., Kipps, T.J., Benacerraf, B., and Dorf, M.E.: Shared idiotypic determinants on antibodies and T cell derived suppressor factor specific for the random

Ronald N. Germain, M.D., Ph.D.

- terpolymer L-glutamic acid⁶⁰-L-alanine³⁰-L-tyrosine¹⁰. *J. Exp. Med.* 149: 613-622, 1979.
24. Dessein, A., Germain, R.N., Dorf, M.E., and Benacerraf, B.: IgE responses to synthetic polypeptide antigens. I. Simultaneous Ir gene and isotype specific regulation of IgE responses to L-glutamic acid⁶⁰-L-alanine³⁰-L-tyrosine¹⁰ (GAT). *J. Immunol.* 123: 463-470, 1979.
25. Pierres, M., Ju, S-T., Waltenbaugh, C., Dorf, M.E., Benacerraf, B., and Germain, R.N.: Fine specificity of antibodies to poly(Glu⁶⁰ Ala³⁰ Tyr¹⁰) produced by hybrid cell lines. *Proc. Natl. Acad. Sci.* 76: 2425-2429, 1979.
26. Ju, S-T., Pierres, M., Waltenbaugh, C., Germain, R.N., Benacerraf, B., and Dorf, M.E.: Idiotypic analysis of monoclonal antibodies to poly-(Glu⁶⁰ Ala³⁰ Tyr¹⁰). *Proc. Natl. Acad. Sci.* 76: 2942-2946, 1979.
27. Germain, R.N., Pierres, M., and Benacerraf, B.: The role of macrophages in determining the balance of regulatory T cells specific for L-glutamic acid⁶⁰-L-alanine³⁰-L-tyrosine¹⁰ (GAT). In *Macrophage Regulation of Immunity*. A.S. Rosenthal and E.R. Unanue (eds.) Academic Press, New York, pp. 15-33, 1979.
28. Pierres, M., Benacerraf, B., and Germain, R.N.: Antigen-specific T cell-mediated suppression. VI. Properties of in vitro generated L-glutamic acid⁶⁰-L-alanine³⁰-L-tyrosine¹⁰ (GAT)-specific T-suppressor factor(s) (GAT-TsF) in responder mouse strains. *J. Immunol.* 123: 2756-2762, 1979.
29. Weinberger, J.Z., Germain, R.N., Ju, S-T., Greene, M.I., Benacerraf, B., and Dorf, M.E.: Hapten specific T cell responses to 4-hydroxy-3-nitrophenyl acetyl. II. Demonstration of idiotypic determinants on suppressor T cells. *J. Exp. Med.* 150: 761-776, 1979.
30. Germain, R.N.: Specific T cell factors with MHC determinants. In: *The Role of the Major Histocompatibility Complex in Immunobiology*. M.E. Dorf (ed.) Garland Press, New York, pp. 303-342, 1981.
31. Germain, R.N.: Tumor immunology. In: *Textbook of Immunology*, B. Benacerraf and E.R. Unanue (eds.) Williams and Wilkins, Baltimore, MD, pp. 196-217, 1979.
32. Germain, R.N., Pierres, M., Ju, S-T., Dorf, M.E., and Benacerraf, B.: Properties of T-suppressor factor specific for L-glutamic acid⁶⁰-L-alanine³⁰-L-tyrosine¹⁰ (GAT). In *Biochemical Characterization of Lymphokines*. A.L. deWeck (ed.), Academic Press, New York, pp. 551-555, 1980.
33. Germain, R.N.: Antigen specific T cell suppressor factors - mode of action. *Lymphokine Reports* 1: 7-39, 1980.
34. Ju, S-T., Pierres, M., Germain, R.N., Benacerraf, B., and Dorf, M.E.: Idiotypic analysis of anti-GAT antibodies. VI. Identification and strain distribution of the GA-1 idiotype. *J. Immunol.* 123: 2505-2510, 1979.

Ronald N. Germain, M.D., Ph.D.

35. Dessein, A., Ju, S-T., Dorf, M.E., Benacerraf, B., and Germain, R.N.: IgE response to synthetic polypeptides antigens. II. Idiotypic analysis of the IgE response to L-glutamic acid⁶⁰-L-alanine³⁰-L-tyrosine¹⁰ (GAT). *J. Immunol.* 124: 71-76, 1980.
36. Zubler, R.H., Cantor, H., Benacerraf, B., and Germain, R.N.: Feedback suppression of the immune response in vitro. I. Activity of antigen stimulated B cells. *J. Exp. Med.* 151: 667-680, 1980.
37. Zubler, R.H., Benacerraf, B., and Germain, R.N.: Feedback suppression of the immune response in vitro. II. IgHV restricted antibody-dependent suppression. *J. Exp. Med.* 151: 681-694. 1980.
38. Germain, R.N.: Complementation of H-2 linked genetic defects in the production and function of antigen specific suppressor factor: Implications for suppressor cell activation. *Mol. Immunol.* 17: 851-856, 1980.
39. Germain, R.N., and Benacerraf, B.: Helper and suppressor T cell factors. *Springer Sem. Immunopath.* 3: 93-127, 1980.
40. Germain, R.N., Waltenbaugh, C., and Benacerraf, B.: Antigen specific T cell mediated suppression. V. H-2 linked genetic control of distinct antigen-specific defects in the production and activity of L-glutamic acid⁵⁰-L-tyrosine⁵⁰ suppressor factor (GT-TsF). *J. Exp. Med.* 151: 1245-1259, 1980.
41. Sy, M-S., Dietz, M.H., Germain, R.N., Benacerraf, B., and Greene, M.I.: Antigen and receptor driven regulatory mechanisms. IV. Idiotype bearing I-J⁺ suppressor T cell factors induce second order suppressor cells which express anti-idiotype receptors. *J. Exp. Med.* 151: 1183-1195, 1980.
42. Letvin, N.L., Greene, M.I., Benacerraf, B., and Germain, R.N.: Immunologic effects of whole body ultraviolet (UV) irradiation. Selective defect in in vitro splenic adherent cell function. *Proc. Natl. Acad. Sci. (USA)*, 77: 2881-2885, 1980.
43. Weinberger, J.Z., Germain, R.N., Benacerraf, B., and Dorf, M.E.: Hapten-specific T-cell responses to 4-hydroxy-3-nitrophenyl acetyl. V. Role of idiotypes in the suppressor pathway. *J. Exp. Med.* 152: 161-169, 1980.
44. Ju, S-T., Pierres, M., Germain, R.N., Benacerraf, B., and Dorf, M.E.: Idiotypic analysis of anti-GAT antibodies. VII. Common idiotype on hybridoma antibodies to poly(Glu⁶⁰-Ala⁴⁰). *J. Immunol.* 125: 1230-1236, 1980.
45. Ju, S-T., Pierres, M., Germain, R., Benacerraf, B., and Dorf, M.E.: Idiotypic analysis of anti-GAT antibodies. VII. Comparison of interstrain and allotype-associated idiotypic specificities. *J. Immunol.* 126: 177-182, 1981.
46. Germain, R.N.: Current concepts of immune regulation. Immunol. Abstr. *Proceeding "Immunology of the eye; Workshop: II"* Eds. Helmsen, R.J., Suran, A., Gery, I. and Nussenblatt, R.B. Sp. Supp. *Immunology Abstracts*, 1981. 261-272, 1981.

Ronald N. Germain, M.D., Ph.D.

47. Sy, M-S., Dietz, M.H., Nisonoff, A., Germain, R.N., Benacerraf, B., and Greene, M.I.: Antigen and receptor driven regulatory mechanisms. V. The failure of idiotype coupled spleen cells to induce unresponsiveness in animals lacking the appropriate VH genes is due to the lack of idiotype matched targets. *J. Exp. Med.* 152: 1226-1235, 1980.
48. Dietz, M.H., Sy, M-S., Greene, M.I., Nisonoff, A., Benacerraf, B., and Germain, R.N.: Antigen and receptor driven regulatory mechanisms. VI. Demonstration of cross-reactive idiotypic determinants on azobenzene-aronate specific suppressor T cells producing soluble suppressor factor(s) *J. Immunol.* 125: 2374-2379, 1980.
49. Letvin, N.L., Fox, I.J., Greene, M.I., Benacerraf, B., and Germain, R.N.: Immunologic effects of whole body ultraviolet (UV) irradiation. II. Defect in splenic adherent cell antigen presentation. *J. Immunol.* 125: 1402-1404, 1980.
50. Letvin, N.L., Nepom, J.T., Greene, M.I., Benacerraf, B., and Germain, R.N.: Loss of Ia bearing splenic adherent cells after whole body ultraviolet irradiation. *J. Immunol.* 125: 2550-2554, 1980.
51. Germain, R.N., and Benacerraf, B.: Hypothesis: A single major pathway of T lymphocyte interactions in antigen specific immune suppression. *Scand. J. Immunol.* 13: 1-10, 1981.
52. Dietz, M.H., Sy, M-S., Benacerraf, B., Nisonoff, A., Greene, M.I., and Germain, R.N.: Antigen and receptor driven regulatory mechanisms. VII. H-2 restricted anti-idiotypic suppressor factor from efferent suppressor T cells. *J. Exp. Med.* 153: 450-463, 1981.
53. Kurzinger, K., Reynolds, T., Germain, R.N., Davignon, D., Martz, E., and Springer, T.A.: Lymphocyte function-associated antigen one (LFA-1). II. Distribution, expression and structure of a novel antigen distinct from Lyt-2,3 and Ly-5. *J. Immunol.* 127: 596-602, 1981.
54. Germain, R.N.: T cell subsets and soluble factors in antigen specific T cell mediated suppression. In: *Recent Advances in Mucosal Immunity*. Strober, W., Hanson, L.A., and Sell, K.W. (Eds.) Raven Press, New York, pp. 83-94, 1981.
55. Picus, J., Germain, R.N., Fox, I.J., Greene, M.I., Benacerraf, B., and Letvin, N.L.: Immunologic effects of whole body ultraviolet (UV) irradiation. III. Defective splenic adherent cell function in concanavalin A and alloantigen stimulated T cell proliferation. *Cell. Immunol.* 63: 300-307, 1981.
56. Letvin, N.L., Benacerraf, B., and Germain, R.N.: B lymphocyte responses to TNP-Ficoll. I. Requirement for T lymphocytes and I-A bearing adherent cells. *Proc. Natl. Acad. Sci.* 78: 5113-5117, 1981.
57. Nepom, G., Benacerraf, B., and Germain, R.N.: Acquisition of syngeneic I-A determinants by T cells proliferating to poly(Glu⁶⁰ Ala³⁰ Tyr¹⁰). *J. Immunol.* 127: 888-892, 1981.
58. Nepom, G.T., Benacerraf, B., and Germain, R.N.: Analysis of Ir gene function using monoclonal antibodies: Independent regulation of GAT and GLPhe T cell responses by I-A and I-E subregion products on a single accessory cell population. *J. Immunol.* 127: 31-34, 1981.
59. Springer, T.A., Kurzinger, K., Reynolds, T., Germain, R.N., Davignon, D. and Martz, E.:

Ronald N. Germain, M.D., Ph.D.

- Monoclonal antibodies as probes of surface structures participating in T lymphocyte function. In *Monoclonal Antibodies and T Cell Hybridomas*. U. Hammerling, G. Hammerling, and J. Kearney (eds.), Elsevier, pp. 45-52, 1981.
60. Sy, M-S., Nisonoff, A., Germain, R.N., Benacerraf, B., and Greene, M.I.: Antigen and receptor driven regulatory mechanisms. VIII. Suppression of idiotype-negative p-azobenzeneearsonate-specific T cells results from the interaction of an anti-idiotypic second-order T suppressor cell with a cross-reactive idiotype-positive p-azobenzene-aronate primed T cell target. *J. Exp. Med.* 153: 1415-1425, 1981.
 61. Germain, R.N., Sy, M-S., Rock, K., Dietz, M.H., Greene, M.I., Nisonoff, A., Weinberger, J.Z., Ju, S-T., Dorf, M.E., and Benacerraf, B.: The role of idiotype and the MHC in suppressor T cell pathways. In: *Immunoglobulin Idiotypes and Their Expression*. C. Janeway, E.E. Sercarz, H. Wigzell, and C.F. Fox (eds.) Academic Press, New York, pp. 709-723, 1981.
 62. Greene, M.I., Bromberg, J.S., Nepom, J., Finberg, R., Whitaker, B., Fox, I., Germain, R.N., Perry, L., Wetzig, R., Takaoki, M., Nisonoff, A., Benacerraf, B., and Sy, M.S.: The role of idiotype in guiding cellular responses. In: *Immunoglobulin Idiotypes and Their Expression*. C. Janeway, E.E. Sercarz, H. Wigzell, and C.F. Fox (eds.) Academic Press, New York, pp. 725-729, 1981.
 63. Germain, R.N.: Accessory cell stimulation of T cell proliferation requires active antigen processing, Ia restricted antigen presentation and a separate non-specific second signal. *J. Immunol.* 127: 1964-1966, 1981.
 64. Germain, R.N., Mayer, S.V., and Mescher, M.F.: Role of I-region gene products in T cell activation. I. Stimulation of T lymphocyte proliferative responses by subcellular membrane preparations containing Ia alloantigens. *J. Immunol.* 128: 506-511, 1981..
 65. Whitaker, R.B., Nepom, J.T., Sy, M.S., Takaoki, M., Gramm, C.F., Fox, I., Germain, R.N., Welles, M.J., Greene, M.I., and Benacerraf, B.: Suppressor factor from a T cell hybrid inhibits delayed type hypersensitivity responses to azobenzeneearsonate. *Proc. Natl. Acad. Sci.* 78: 6441-6445, 1981
 66. Takaoki, M., Sy, M-S., Whitaker, B., Nepom, J., Finberg, R., Germain, R.N., Nisonoff, A., Benacerraf, B., and Greene, M.I.: Biological activity of an idiotype-bearing suppressor factor produced by a long-term T cell hybridoma. *J. Immunol.* 128: 49-53, . 1981.
 67. Letvin, N.L., Benacerraf, B., and Germain, R.N.: Plaque-forming responses to trinitrophenyl (TNP)-L-glutamic acid 60-L-alanine30L-tyrosine10 (GAT) in microcultures are not under conventional Ir gene control. *J. Immunol.* 127: 1534-1538, 1981.
 68. Weinberger, O., Germain, R.N., Springer, T., and Burakoff, S.J.: Role of syngeneic Ia accessory cells in the generation of allospecific responses. *J. Immunol.* 129: 694-697, 1982.
 69. Weinberger, O., Germain, R.N., and Burakoff, S.J.: Responses to the H-2K^{ba} mutant proceed via recognition of syngeneic Ia. *Nature.* 302: 429-431, 1983.
 70. Robinson, R.R., Germain, R.N., McKean, D.J., Mescher, M., and Seidman, J.G.: Extensive polymorphism surrounding the single murine I-A β chain gene. *J. Immunol.* 131: 2025-2031.

Ronald N. Germain, M.D., Ph.D.

1982.

71. Germain, R.N., Robinson, R., McKean, D., Choi, E., Mescher, M., and Seidman, J.: Extensive restriction site polymorphism surrounding a single copy I-A β gene. In: *Ir Genes: Past, Present and Future*. C.W. Pierce (ed.), Humana Press, Inc., pp. 223-231, 1982.
72. Germain, R.N., Weinberger, O., Rock, K., and Burakoff, S.J.: Involvement of syngeneic Ia in T cell responses to Class I alloantigens. In: *Ir Genes: Past, Present and Future*. C.W. Pierce (ed.), Humana Press, Inc., pp. 367-376, 1982.
73. Auffray, C., Benn-Nun, A., Roux-Dosseto, M., Germain, R.N., Seidman, J.G., and Strominger, J.L.: Polymorphism and complexity of the human DC and murine I-A α chain genes. *EMBO J.* 2: 121-124, 1983.
74. Rock, K.L., Barnes, M.C., Germain, R.N., and Benacerraf, B.: The role of Ia molecules in the activation of T lymphocytes: II. Ia restricted recognition of allo K/D antigens is required for class I MHC stimulated mixed lymphocyte responses. *J. Immunol.* 130: 457-462, 1983.
75. Riley, R.L., Wilson, L.D., Germain, R.N., and Benjamin, D.C.: Immune responses to complex protein antigens. I. MHC control of immune responses to bovine albumin. *J. Immunol.* 129: 1553-1558, 1982.
76. Choi, E., McIntyre, K., Germain, R.N., and Seidman, J.G.: Murine I-A β chain polymorphism: Nucleotide sequences of three allelic I-A β genes. *Science* 221: 283-286, 1983.
77. Samelson, L.E., Germain, R.N., and Schwartz, R.H.: Monoclonal antibodies against the antigen receptor on a cloned T cell hybrid. *Proc. Natl. Acad. Sci. USA* 80: 6972-6976, 1983.
78. Germain, R., Norcross, M., and Margulies, D.: Functional expression of a transfected murine class II MHC gene. *Nature*. 306: 190-194, 1983.
79. Germain, R.N.: Regulatory and effector cell interactions in immune responses. Morrison, W.I. (ed.) *The Ruminant, Immune System in Health and Disease*. Cambridge University Press, Cambridge, pp. 261-280, 1986.
80. Germain, R.N., Norcross, M.A., Bentley, D.M., and Margulies, D.H.: Molecular genetic analysis of Ia structure and function. In *Regulation of the Immune System*. UCLA Symposium on Molecular and Cellular Biology, Sercarz, E., Cantor, H., Chess, L. (Eds.) New Series, V. 18. Alan R. Liss, Inc., New York, pp. 15-28, 1984.
81. Norcross, M. A., Bentley, D. M., Margulies, D. H., and Germain, R. N.: Membrane Ia expression and antigen-presenting accessory cell function of L-cells transfected with class II MHC genes. *J. Exp. Med.* 160: 1316-1337, 1984.
82. Rogers, M. J., Germain, R. N., Hare, J., Long, E., and Singer, D. S.: Comparison of MHC genes among distantly related members of the genus *mus*. *J. Immunol.* 134: 630-636, 1985.
83. Germain, R. N., Bentley, D. M., Brown, M. A., Lechler, R., Margulies, D. H., Norcross, M. A., and Tou, J.: Use of molecular techniques for analysis of Ia structure-function relationship. *Fed. Proc.* 44: 2730-2735, 1985.

Ronald N. Germain, M.D., Ph.D.

84. Germain, R. N., Ashwell, J. D., Lechler, R. I., Margulies, D. H., Nickerson, K. M., Suzuki, G., and Tou, J. Y. L.: Exon-shuffling maps control of antibody and T cell recognition sites to the NH₂-terminal domain of Aβ. *Proc. Natl. Acad. Sci.* 82: 2940-2944, 1985.
85. Miller, J., Malek, T. R., Leonard, W. J., Greene, W. C., Shevach, E. M., and Germain, R. N.: Nucleotide sequence and expression of a mouse interleukin-2 receptor cDNA. *J. Immunol.* 134: 4212-4217, 1985.
86. McCluskey, J., Germain, R. N., and Margulies, D. H.: Cell surface expression of an in vitro recombinant class II/class I major histocompatibility complex gene product. *Cell.* 40: 247-257,
87. Hedrick, S. M., Germain, R. N., Bevan, M. J., Dorf, M., Engel, I., Fink, P., Gascoigne, N., Heber-Katz, E., Kapp, J., Kaufman, Y., Kaye, J., Melchers, F., Pierce, C., Schwartz, R. H., Sorenson, C., Taniguchi, M., and Davis, M. M.: Rearrangement and transcription of a T cell receptor beta chain gene in different T cell subsets. *Proc. Natl. Acad. Sci. USA*, 82: 531-535, 1985.
88. Hodes, R. J., Germain, R. N., and Bluestone, J. A.: The regulation of the immune system. *Immunol. Today* 5: 279-285, 1984.
89. Samelson, L.E., Lindsten, T., Fowlkes, B.J., van den Elsen, P., Terhorst, C., Davis, M.M., Germain, R.N., and Schwartz, R.H.: The expression of genes of the T cell antigen receptor complex in precursor thymocytes. *Nature.* 315: 765-768, 1985.
90. Malek, T.R., Chan, C., Glimcher, L.H., Germain, R.N., and Shevach, E.: Influence of accessory cell and T cell surface antigens on mitogen-induced IL-2 receptor expression. *J. Immunol.* 135: 1826-1833, 1985.
91. Lechler, R.I., Norcross, M.A., and Germain, R.N.: Qualitative and quantitative studies of antigen presenting cell function using I-A expressing L cells. *J. Immunol.* 135: 2914-2922, 1985.
92. Golding, H., McCluskey, J., Munitz, T.I., Germain, R.N., Margulies, D.H., and Singer, A.: T cell recognition of a chimeric class II/class I MHC molecule and the role of L3T4. *Nature.* 317: 425-429, 1985.
93. Germain, R.N., Bentley, D.M., and Quill, H.: Influence of allelic polymorphism on the assembly and surface expression of class II MHC (Ia) molecules. *Cell.* 43: 233-242, 1985.
94. Brown, M.A., Glimcher, L.H., Nielsen, E., Paul, W.E., and Germain, R.N.: A single amino acid substitution selectively alters T cell recognition of Ia molecules. *Science.* 231: 255-258, 1985.
95. Germain, R.N., Braunstein, N.S., Brown, M.A., Glimcher, L.H., Lechler, R.I., McCluskey, J., Margulies, D.H., Miller, J., Norcross, M.A., Paul, W.E., Quill, H., and Ronchese, F.: Structure and function of murine class II MHC genes. *Mt. Sinai J. Med.* 53: 194-201, 1986.
96. Germain, R.N., and Malissen, B.: Analysis of the expression and function of class II major histocompatibility complex-encoded molecules by DNA-mediated gene transfer. *Ann. Rev. Immunol.* 4: 281-316, 1986.

Ronald N. Germain, M.D., Ph.D.

97. Gunter, K., Kroczeck, R., Shevach, E., and Germain, R.N.: Functional expression of the murine Thy 1.2 gene in transfected human T cells. *J. Exp. Med.* 163: 285-300, 1986.
98. Germain, R.N., and Quill, H.: Unexpected expression by L cell transfectants of unique mixed-isotype (A β :E α) class II MHC molecule. *Nature*. 320: 72-75, 1986.
99. Lechler, R.I., Ronchese, F., Braunstein, N.S. and Germain, R.N.: I-A restricted antigen recognition: Analysis of the roles of A α and A β using DNA-mediated gene transfer. *J. Exp. Med.* 163: 678-696, 1986.
100. Norcross, M.A., Raghupathy, R., Strominger, J., and Germain, R.N.: Transfected human B lymphoblastoid cells express the mouse A β^d chain in association with DR . *J. Immunol.* 137: 1714-1717, 1986.
101. Kroczeck, R.A., Gunter, K.C., Germain, R.N., and Shevach, E.M.: Thy-1 functions as a signal transduction molecule in T- lymphocytes and transfected B-lymphocytes. *Nature* 322: 181-184, 1986.
102. Miller, J., Malek, T.R., Shevach, E.M., and Germain, R.N.: Molecular analysis of the murine interleukin-2 receptor. In *Molecular Cloning and Analysis of Lymphokines*. Webb, D. & Goeddel, D. (Ed.) Academic Press, New York, pp. 123-135, 1987.
103. Malek, T.R., Ashwell, J.D., Germain, R.N., Shevach, E.M., and Miller, J.: The murine interleukin-2 receptor: Biochemical structure and regulation of expression. *Immunol. Rev.* 92: 81-102, 1986.
104. Braunstein, N.S., and Germain, R.N.: The mouse E β 2 gene: A class II MHC β gene with limited intraspecies polymorphism and an unusual pattern of transcription. *EMBO Journal*. 5: 2469-2476, 1986.
105. Germain, R.N.: Antigen processing is not restricted to specialized hematopoietic accessory cells. *Ann. Inst. Pasteur*. 137: 334-338, 1986.
106. Germain, R.N.: The ins and outs of antigen processing and presentation. *Nature*. 322: 687-689, 1986.
107. Miller, J., and Germain, R.N.: Efficient cell surface expression of class II MHC molecules in the absence of associated invariant chain. *J. Exp. Med.* 164: 1478-1489, 1986.
108. McCluskey, J., Singer, A., Germain, R.N., and Margulies, D.H.: The role of CD4/L3T4 in T lymphocyte function. *Ann. Inst. Pasteur*. 138: 150-157, 1986.
109. Saito, T., Weiss, A., Miller, J., Norcross, M.A., and Germain, R.N.: Specific antigen-Ia activation of transfected human T cells expressing murine Ti β -human T3 complexes. *Nature* 325: 125-129, 1986.
110. Stingl, G., Gunter, K.C., Tschachler, E., Yamada, H., Lechler, R.I., Yokoyama, W.M. Steiner, G., Germain, R.N., and Shevach, E.M.: Thy-1 $^{+}$ dendritic epidermal cells belong to the T cell lineage. *Proc. Natl. Acad. Sci. U.S.A.* 84: 2430-2434, 1987.

Ronald N. Germain, M.D., Ph.D.

111. Braunstein, N.S., and Germain, R.N.: Allele-specific control of Ia surface expression and molecular conformation: Implications for a general model of Ia structure-function relationships. *Proc. Natl. Acad. Sci. U.S.A.* 84: 2921-2925, 1987.
112. Lew, A.M., Pardoll, D.M., Maloy, W.L., Fowlkes, B.J., Kruisbeck, A., Cheng, S.-F., Germain, R.N., Bluestone, J.A., Schwartz, R.H., and Coligan, J.E.: Characterization of T-cell receptor gamma chain expression in a subset of murine thymocytes. *Science*. 234: 1401-1405, 1986.
113. Gunter, K.C., Germain, R.N., Kroczeck, R.A., Saito, T., Yokoyama, W.H., Chan, C., Weiss, A., and Shevach, E.M.: Thy-1 mediated T-cell activation requires co-expression of the T3-Ti complex. *Nature*. 326: 505-507, 1987.
114. Ronchese, F., Brown, M.A., and Germain, R.N.: Structure-function analysis of the A β mutation using site-directed mutagenesis and DNA-mediated gene transfer. *J. Immunol.* 139: 629-638, 1987.
115. Pardoll, D.M., Fowlkes, B.J., Lechler, R.I., Germain, R.N., and Schwartz, R.H.: Early genetic events in T-cell development analyzed by in situ hybridization. *J. Exp. Med.* 165: 1624-1638, 1987.
116. Fertsch, D., Schoenberg, D.R., Germain, R.N., Tou, J., and Vogel, S.N.: Analysis of Ia antigen expression in murine macrophages: Induction by rIFN- γ and down-regulation by IFN- α/β and dexamethasone are mediated by changes in steady-state levels of Ia mRNA. *J. Immunol.* 139: 244-249, 1987.
117. Saito, T., Weiss, A., Gunter, K., Shevach, E.M., and Germain, R.N.: Cell-surface T3 expression requires the presence of both α and β chains of the T cell receptor. *J. Immunol.* 139: 625-628, 1987.
118. Braunstein, N.S., Ronchese, F., Sant, A., Schwartz, R.H., Lechler, R.I., and Germain, R.N.: DNA-mediated gene transfer as a tool for analyzing Ia structure-function relationships and antigen presentation. In: *Antigen Presenting Cells*, J.Tew and L.Schook, ed. Alan R. Liss Inc. New York, NY. pp. 145-154, 1987.
119. McCoy, K.L., Robbins, A., Miller, J., Ronchese, F., Germain, R., and Schwartz, R.H.: 1987. Antigen presentation and processing by temperature sensitive endocytotic mutants. In *Antigen Presenting Cells*, J. Tew and L. Schook, Ed., Alan R. Liss, New York, N.Y. pp. 105-114, 1988.
120. Sant, A., Braunstein, N.S., and Germain, R.N.: Predominant role of NH₂-terminal sequences in dictating efficiency of class II MHC $\alpha\beta$ dimer expression. *Proc. Natl Acad. Sci. (USA)*, 84: 8065-8069, 1987.
121. Ronchese, F., Schwartz, R.H., and Germain, R.N.: 1987. Functionally distinct subsites on a class II major histocompatibility complex molecule. *Nature*. 329: 254-256.
122. Saito, T., and Germain, R.N.: Predictable acquisition of a new MHC recognition specificity following expression of a transfected T-cell receptor β chain gene. *Nature*, 329: 256-259, 1987.

Ronald N. Germain, M.D., Ph.D.

123. Germain, R.N., Braunstein, N.S., Lechler, R.I., Miller, J., Ronchese, F., and Sant, A.J.: Ia structure and immune recognition. In Antigen Processing and Presentation. Vogel, H., Pernis, B., and Alt, F. (Eds.) pp. 99-124, 1988.
124. Saito, T., and Germain, R.N.: The molecular basis of MHC-restricted antigen recognition by T cells. *Intern. Rev. Immunol.*, 3: 147-174, 1988.
125. Marusic-Galesic, S., Pardoll, D.M., Saito, T., Leo, O., Fowlkes, B.J., Coligan, J., Germain, R.N., Schwartz, R.H., and Kruisbeek, A.M.: Activation properties of T cell receptor $\gamma\delta$ hybridomas expressing diversity in both γ and δ chains. *J. Immunol.*, 140: 411-418, 1988.
126. Fox, B.S., Carbone, F.R., Germain, R.N., Paterson, Y., and Schwartz, R.H.: Processing of a minimal antigenic peptide alters its interaction with MHC molecules and its ability to elicit an immune response. *Nature*, 331: 538-540, 1988.
127. Gunter, K.C., Germain, R.N., Leo, O., Chan, C., and Shevach, E.M.: Functional properties of EL-4 Thy-1 negative cell lines. *Cell. Immunol.*, 112: 135-146, 1988.
128. McCluskey, J., Munitz, T., Boyd, L., Germain, R.N., Coligan, J.E., Singer, A., and Margulies, D.H.: Cell surface expression of the amino-terminal domain of $A\alpha^k$: recognition of an isolated major histocompatibility complex antigenic structure by allospecific T cells but not alloantibodies. *J. Immunol.*, 140: 2081-2089, 1988.
129. Saito, T., and Germain, R.N.: The generation and selection of the T cell repertoire: Insights from studies of the molecular basis of T cell recognition. *Immunol. Rev.* 101: 81-113, 1988.
130. Sussman, J.J., Saito, T., Shevach, E.M., Germain, R.N., and Ashwell, J.D.: Thy-1 and Ly-6-mediated lymphokine production and growth inhibition of T cell hybridoma require co-expression of the T cell antigen receptor complex. *J. Immunol.* 140: 2520-2526, 1988.
131. Takahashi, H., Cohen, J., Hosmalin, A., Cease, K., Houghten, R., Cornette, J.K., DeLisi, C., Moss, B., Germain, R.N., and Berzofsky, J.A.: An immunodominant epitope of the HIV gp160 envelope glycoprotein recognized by class I MHC molecule-restricted murine cytotoxic T lymphocytes. *Proc. Natl. Acad. Sci. (USA)* 85: 3105-3109, 1988.
132. Sussman, J., Mercep, M., Saito, T., Germain, R.N., Bonvini, E., and Ashwell, J.D.: Dissociation of phosphoinositide hydrolysis and increases in intracellular Ca^{2+} from the biological responses of a T cell hybridoma. *Nature*, 334: 625-629, 1988.
133. Saito, T., Hochstenbach, F., Marusic-Galesic, S., Kruisbeek, A., Brenner, M., and Germain, R.N.: Surface expression of only $\gamma\delta$ and/or $\alpha\beta$ T cell receptor heterodimers by cells with four ($\alpha, \beta, \gamma, \delta$) functional receptor chains. *J. Exp. Med.* 168: 1003-1020, 1988.
134. Germain, R.N.: Antigen processing and CD4+ T cell depletion in AIDS. *Cell*, 54: 441-444, 1988.
135. Takahashi, H., Cohen, J., Hosmalin, A., Cease, K.B., Houghton, R., Cornette, J.L., DeLisi, C., Merli, S., Moss, B., Germain, R.N., and Berzofsky, J.A.: Limited epitope repertoire recognized with class I MHC molecules by cytotoxic T lymphocytes on the HIV gp160 envelope

Ronald N. Germain, M.D., Ph.D.

- glycoprotein. In: *Vaccines '89*, R. Lerner, H. Ginsberg, R. Chanock, and F. Brown, eds., Cold Spring Harbor Press, Cold Spring Harbor, pp. 109-114, 1989.
136. Lechler, R.I., Bal, V., Rothbard, J.B., Germain, R.N., Sekaly, R., Long, E.O., and Lamb, J.: Structural and functional studies of HLA-DR restricted antigen recognition by human helper T lymphocyte clones by using transfected murine cell lines. *J. Immunol.* 141: 3003-3009, 1988.
 137. Sant, A.J., and Germain, R.N.: Intracellular competition for component chains determines class II MHC surface phenotype. *Cell.* 57: 797-805, 1989.
 138. Germain, R.N., Sant, A.J., Braunstein, N.S., and Ronchese, F.: The molecular basis of antigen presentation. In: *Immune System and Cancer*, T. Hamaoka, et al. (Ed.). Japan. Sci. Press, Tokyo, pp. 181-193, 1989.
 139. McCoy, K.L., Miller, J., Jenkins, M., Ronchese, F., Germain, R.N., and Schwartz, R.H.: Diminished antigen processing by endosomal acidification mutant antigen-presenting cells. *J. Immunol.* 143: 29-38, 1989.
 140. Bill, J., Ronchese, F., Germain, R.N., and Palmer, E.: The contribution of mutant amino acids to alloantigenicity. *J. Exp. Med.* 170: 739-750, 1989.
 141. Takahashi, H., Merli, S., Putney, S.D., Houghten, R., Moss, B., Germain, R.N., and Berzofsky, J.A.: A single amino acid interchange yields reciprocal CTL specificities for HIV-1 gp160. *Science.* 246: 118-121, 1989.
 142. Saito, T., Sussman, J.J., Ashwell, J.D., and Germain, R.N.: Marked differences in the efficiency of expression of distinct $\alpha\beta$ T cell receptor heterodimers. *J. Immunol.* 143: 3379-3384, 1989.
 143. Takahashi, H., Houghten, R., Putney, S.D., Margulies, D.H., Moss, B., Germain, R.N., and Berzofsky, J.A.: Structural requirements for class I MHC molecule-mediated antigen presentation and cytotoxic T cell recognition of an immunodominant determinant of the human immunodeficiency virus envelope protein. *J. Exp. Med.* 170: 2023-2035, 1989.
 144. Lechler, R.I., Sant, A.J., Braunstein, N.S., Sekaly, R., Long, E., and Germain, R.N.: Cell surface expression of hybrid murine/human MHC class II $\beta\alpha$ dimers. Key influence of residues in the amino-terminal portion of the $\beta 1$ domain. *J. Immunol.* 144: 329-333, 1990.
 145. Takahashi, H., Germain, R.N., Moss, B., and Berzofsky, J.A.: An immunodominant class I-restricted cytotoxic T lymphocyte determinant of human immunodeficiency virus type 1 induces CD4 class II-restricted help for itself. *J. Exp. Med.* 171: 571-576, 1990.
 146. Germain, R.N.: Making a molecular match. *Nature.* 344: 19-22, 1990.
 147. Hosmalin, A., Clerci, M., Houghten, R., Pendleton, C.D., Flexner, C., Lucey, D.R., Moss, B., Germain, R.N., Shearer, G.M., and Berzofsky, J.A.: An epitope in human immunodeficiency virus 1 reverse transcriptase recognized by both mouse and human cytotoxic T lymphocytes. *Proc. Natl. Acad. Sci. (USA).* 87: 2344-2348, 1990.
 148. Takahashi, H., Houghten, R., Merli, S., Putney, S.D., Moss, B., Germain, R.N., and Berzofsky, J.A.: Immunodominant CTL epitope of HIV-1 envelope protein: The relationship between viral

Ronald N. Germain, M.D., Ph.D.

- mutation and CTL specificity. In: *Vaccines 90*, F. Brown, R. Chanock, H. Ginsberg, and R. Lerner, eds. Cold Spring Harbor Press, Cold Spring Harbor, pp. 269-276, 1990.
149. Takahashi, H., Takeshita, T., Morein, B., Putney, S., Germain, R.N., and Berzofsky, J.A.: Induction of CD8⁺ cytotoxic T cells by immunization with purified HIV-1 envelope protein in ISCOMs. *Nature*. 344: 873-875, 1990.
150. Braunstein, N.S., Germain, R.N., Loney, K., and Berkowitz, N.: Structurally interdependent and independent regions of allelic polymorphism in class II MHC molecules: Implications for Ia function and evolution. *J. Immunol.* 145: 1635-1645, 1990.
151. Takahashi, H., Takeshita, T., Morein, B., Putney, S., Germain, R.N., and Berzofsky, J.A.: A unique subunit immunogen (ISCOM-gp160) can elicit MHC class I-restricted HIV-envelope-specific CD8⁺ CTL. In: *Vaccines 91*, Chanock, R., Ginsberg, H., Brown, F., and Lerner, R. (Eds.), pp. 1-7, 1991.
152. Kozlowski, S., Takeshita, T., Boehncke, W.-H., Takahashi, H., Boyd, L.F., Germain, R.N., Berzofsky, J.A., and Margulies, D.H.: Excess β_2 microglobulin promoting functional peptide association with purified soluble class I MHC molecules. *Nature* 349: 74-77, 1991.
153. Layet, C., and Germain, R.N.: Invariant chain promotes egress of poorly expressed, haplotype-mismatched class II major histocompatibility complex A α A β dimers from the endoplasmic reticulum/cis-Golgi compartment. *Proc. Natl. Acad. Sci. (USA)*. 88: 2346-2350, 1991.
154. Otten, G.R., and Germain, R.N.: Split anergy in a CD8⁺ T cell receptor-dependent cytolysis in the absence of interleukin-2 production. *Science*. 251: 1228-1231, 1991.
155. Ohno, H., Ushiyama, C., Taniguchi, M., Germain, R.N., and Saito, T.: CD2 can mediate TCR/CD3-independent T cell activation. *J. Immunol.* 146: 3742-3746, 1991.
156. Sant, A.J., Hendrix, L.R., Coligan, J.E., Maloy, W.L., and Germain, R.N.: Defective intracellular transport as a common mechanism limiting expression of inappropriately paired class II major histocompatibility complex $\alpha\beta$ chains. *J. Exp. Med.* 174: 799-808, 1991.
157. Germain, R.N., and Hendrix, L.R.: MHC class II structure, occupancy, and surface expression determined by post-endoplasmic reticulum antigen binding. *Nature*. 353: 134-139, 1991.
158. Sadegh-Nasseri, S., and Germain, R.N.: A role for peptide in determining MHC class II structure. *Nature*, 353: 167-170, 1991.
159. Germain, R.N.: The second class story. *Nature*. 353: 605-607, 1991.
160. Racioppi, L., Ronchese, F., Schwartz, R.H., and Germain, R.N.: The molecular basis of class II MHC allelic control of T cell responses. *J. Immunol.* 147: 3718-3727, 1991.
161. Bikoff, E.K., Jaffe, L., Ribaudo, R.K., Otten, G.R., Germain, R.N. and, Robertson, E.J.: MHC class I surface expression in embryo-derived cell lines inducible with peptide or interferon. *Nature*. 354: 235-238, 1991.

Ronald N. Germain, M.D., Ph.D.

162. Germain, R.N.: Antigenicity versus immunogenicity: Significance for T-cell-dependent vaccine development. Modern approaches to new vaccines including prevention of AIDS. In: *Vaccines 92*, Brown, F., Chanock, R.M., Ginsberg, H.S., Lerner, R.A., eds. Cold Spring Harbor Laboratory Press, Cold Spring Harbor, pp. 1-7, 1992.
163. Takahashi, H., Nakagawa, Y., Pendleton, C.D., Houghten, R.A., Yokomuro, K., Germain, R.N., and Berzofsky, J.A.: Analysis of CTL crossreactivity to an HIV-1 immunodominant determinant: Elicitation of widely crossreactive CTL. Modern approaches to new vaccines including prevention of AIDS. In: *Vaccines 92*, Brown, F., Chanock, R.M., Ginsberg, H.S., Lerner, R.A., eds. Cold Spring Harbor Laboratory Press, Cold Spring Harbor, pp. 69-74, 1992.
164. Ruberti, G., Sellins, K.S., Germain, R.N., Fathman, C.G. and Livingstone, A.: Presentation of antigen by mixed isotype class II molecules in normal H-2^d mice. *J. Exp. Med.* 175: 157-162, 1992.
165. Takahashi, H., Nakagawa, Y., Pendleton, C.D., Houghten, R.A., Yokomuro, K., Germain, R.N., and Berzofsky, J.A.: Induction of broadly cross-reactive cytotoxic T cells recognizing an HIV-1 envelope determinant. *Science*. 255: 333-336, 1992.
166. Sadegh-Nasseri, S., and Germain, R.N.: How MHC class II molecules work: Peptide dependent completion of protein folding. *Immunol. Today*. 13: 43-46, 1992.
167. Kozlowski, S., Corr, M., Takeshita, T., Boyd, L.F., Pendleton, C.D., Germain, R.N., Berzofsky, J.A., and Margulies, D.H.: Serum angiotensin-1 converting enzyme activity processes a human immunodeficiency virus 1 gp160 peptide for presentation by major histocompatibility complex class I molecules. *J. Exp. Med.* 175: 1417-1422, 1992.
168. Otten, G.R., Bikoff, E., Ribaudo, R.K., Kozlowski, S., Margulies, D.H., and Germain, R.N.: Peptide and β_2 -microglobulin regulation of cell surface MHC class I conformation and expression. *J. Immunol.* 148: 3723-3732, 1992.
169. Koenig, R., Huang, L-Y., and Germain, R.N.: MHC class II interaction with CD4 mediated by a region analogous to the MHC class I binding site for CD8. *Nature*. 356: 796-798, 1992.
170. Germain, R.N.: Antigen processing and presentation. *AIDS Res. Hum. Retroviruses*. 8: 769-776, 1993.
171. Germain, R.N., and Margulies, D.H.: The biochemistry and cell biology of antigen processing and presentation. *Annu. Rev. Immunol.*, 11: 403-450, 1993.
172. Romagnoli, P., Layet, C., Yewdell, J., Bakke, O., and Germain, R.N.: Relationship between invariant chain expression and major histocompatibility complex class II transport into early and late endocytic compartments. *J. Exp. Med.*, 177: 583-596, 1993.
173. Boehncke, W-H., Takeshita, T., Pendleton, C.D., Houghten, R.A., Sadegh-Nasseri, S., Racioppi, L., Berzofsky, J.A., and Germain, R.N.: The importance of dominant negative effects of amino acid side chain substitution in peptide-MHC molecule interactions and T cell recognition. *J. Immunol.*, 150: 331-341, 1993.

Ronald N. Germain, M.D., Ph.D.

174. Racioppi, L., Ronchese, F., Matis, L.A., and Germain, R. N.: Peptide-major histocompatibility complex class II complexes with mixed agonist/antagonist properties provide evidence for ligand-related differences in T cell receptor-dependent intracellular signaling. *J. Exp. Med.* 177:1047-1060, 1993.
175. Germain, R. N. and Rinker, A. G., Jr.: Peptide binding inhibits protein aggregation of invariant-chain free class II dimers and promotes surface expression of occupied molecules. *Nature*, 363: 725-728, 1993.
176. Bikoff, E. K., Huang, L-Y., Episkopou, V., van Meerwijk, J., Germain, R.N., and Robertson, E. J.: Defective major histocompatibility complex class II assembly, transport, peptide acquisition, and CD4+ T cell selection in mice lacking invariant chain expression. *J. Exp. Med.* 177: 1699-1712, 1993.
177. Ding, L. Linsley, P. S., Huang, L-Y., Germain, R. N., and Shevach, E. M.: IL-10 inhibits macrophage co-stimulatory activity by selectively inhibiting upregulation of B7 expression. *J. Immunol.* 151: 1224-1234, 1993.
178. Hahn, W.C., Menzin, E., Saito, T., Germain, R.N., and Bierer, B.E.: The complete sequences of plasmids pfNeo and pMH-Neo: Convenient expression vectors for high-level expression of eukaryotic genes in hematopoietic cell lines. *Gene*. 127: 267-268, 1993.
179. van Meerwijk, J.P.M., and Germain, R.N.: Development of mature CD8+ thymocytes: Selection rather than instruction? *Science*. 261: 911-915, 1993.
180. Germain, R.N.: Antigen processing and presentation. *Fundamental Immunology* 3rd Edition. (ed. Paul, W.E.) Raven Press. pp. 629-676, 1993.
181. Germain, R.N.: Seeing double! *Current Biology*. 3: 586-589, 1993.
182. Germain, R.N.: Modern concepts in immune recognition and lymphocyte activation: Relevance for development of useful vaccines. *Internat. J. Technology Assessment in Health Care*, 10:1, 81-92, 1994.
183. Germain, R.N.: MHC-dependent antigen processing and peptide presentation: Providing ligands for T lymphocyte activation. *Cell*. 76: 287-299, 1994.
184. Jarvis, C.D., Germain, R.N., Hager, G.L., Damschroder, M., and Matis, L.A.: Tissue-specific expression of messenger RNAs encoding viral superantigens. *J. Immunol.* 1032-1038, 1994.
185. Bonnerot, C., Marks, M.S., Cosson, P., Robertson, E.J., Bikoff, E.K., Germain, R.N., and Bonifacino, J.S.: Association with BiP and aggregation of class II molecules synthesized in the absence of invariant chain. *EMBO Journal*. 13: 934-944, 1994.
186. Seder, R.A., Germain, R.N., Linsley, P.S., and Paul, W.E.: CD28-mediated costimulation of interleukin 2 (IL-2) production plays a critical role in T cell priming for IL-4 and interferon production. *J. Exp. Med.* 179: 299-304, 1994.
187. Romagnoli, P., Castellino, F., and Germain, R.N.: Regulation of MHC class II intracellular

Ronald N. Germain, M.D., Ph.D.

- transport and peptide loading. *Antigen Processing and Presentation*. (eds. R.E. Humphreys and Susan Pierce). pp. 109-123, 1994.
188. van Meerwijk, J.P.M., and Germain, R.N.: The different roles of MHC class recognition in thymocyte CD4 versus CD8 lineage commitment and positive selection. *Seminars in Immunology*, 6: 231-240, 1994.
 189. Romagnoli, P., and Germain, R.N.: The CLIP region of invariant chain plays a critical role in regulating MHC class II folding, transport, and peptide occupancy. *J. Exp. Med.* 180, 1107-1113, 1994.
 190. Sadegh-Nasseri, S., Stern, L.J., Wiley, D.C., and Germain, R.N.: Specific low affinity peptide binding precedes stable complex formation and preserves the function of MHC class II molecules. *Nature*. 370: 647-650, 1994.
 191. Racioppi, L., and Germain, R.N.: Modified T cell receptor ligands: Moving beyond a strict occupancy model for T cell activation by antigen. Selective Immunosuppression: Basic Concepts and Clinical Applications. Karger, Basel; L. Adorini, ed. *Chem. Immunol.* 60: 79-99, 1995.
 192. Germain, R.N.: The biochemistry and cell biology of antigen presentation by MHC class I and class II molecules: Implications for development of combination vaccines. Combined Vaccines and Simultaneous Administration: *Current Issues and perspectives*. Book Chapter. Annals of the New York Academy of Sciences. 754: 114-125, 1995.
 193. König, R., Fleury, S., and Germain, R.N.: The structural basis of CD4 - MHC class II interactions: Coreceptor contributions to T cell receptor antigen recognition and oligomerization-dependent signal transduction. *Contemp. Topics in Micro. and Immunol.* 205: 19-46, 1995.
 194. Castellino, F., Germain, R.N.: Extensive trafficking of newly synthesized MHC class II-invariant chain complexes in the endocytic pathway and appearance of peptide-loaded class II molecules in multiple compartments. *Immunity*. 2: 73-88, 1995.
 195. Madrenas, J., Wange, R.L., Wang, J.L., Isakov, N., Samelson, L.E., and Germain, R.N.: ζ phosphorylation without ZAP-70 activation induced by TCR antagonists or partial agonists. *Science*. 267: 515-518, 1995.
 196. Marks, M.S., Germain, R.N., and Bonifacino, J.S.: Transient aggregation of major histocompatibility complex class II chains during assembly in normal spleen cells. *J. Biol. Chem.* 270: 10475-10481, 1995.
 197. van Meerwijk, J.P.M., O'Connell, E.M., and Germain, R.N.: Evidence for lineage commitment and initiation of positive selection by thymocytes with intermediate surface phenotypes. *J. Immunol.* 154: 6314-6323, 1995.
 198. Bikoff, E.K., Germain, R.N., and Robertson, E.J.: Allelic differences affecting invariant chain dependency of MHC class II subunit assembly. *Immunity*. 2: 301-310, 1995.
 199. Reis e Sousa, C., and Germain, R.N.: MHC class I presentation of peptides derived from soluble

Ronald N. Germain, M.D., Ph.D.

- exogenous antigen by a subset of cells engaged in phagocytosis. *J. Exp. Med.* 182: 841-852, 1995.
200. Germain, R. N., Levine, E. H. and Madrenas, J.: The T-cell receptor as a diverse signal transduction machine. *The Immunologist*. 3: 113-121, 1995.
201. König, R., Shen, X. and Germain, R. N.: Involvement of both MHC class II α and β chains in CD4 function indicates a role for ordered oligomerization in T cell function. *J Exp Med.* 182: 779-787, 1995.
202. Romagnoli, P. and Germain, R. N.: Inhibition of invariant chain (Ii)-calnexin interaction results in enhanced degradation of Ii, but does not prevent assembly of Ii complexes. *J Exp Med.* 182: 2027-2036, 1995.
203. Germain, R. N.: Binding domain regulation of MHC class II molecule assembly, trafficking, fate, and function. *Sem Immunol.* 7: 361-372, 1995.
204. Germain, R.N.: MHC-associated antigen processing, presentation, and recognition: Adolescence, maturity, and beyond. *The Immunologist* 3: 185-190, 1995.
205. Madrenas, J. and Germain, R. N.: Variant TCR ligands: New insights into the molecular basis of antigen-dependent signal transduction and T cell activation. *Sem Immunol.* 8: 83-101, 1996.
206. Germain, R.N., Castellino, F., Han, R., Reis e Sousa, C., Romagnoli, P., Sadegh-Nasseri, S., and Zhong, G.: Processing and presentation of endocytically acquired protein antigens by MHC class II and class I molecules. *Immunol. Rev.* 151: 5-30, 1996.
207. Reis e Sousa, C., Levine, E.H., and Germain, R.N.: Partial signaling by CD8 $^{+}$ T cells in response to antagonist ligands. *J. Exp. Med.* 184: 149-157, 1996.
208. Lucas, B. and Germain, R. N.: Political correctness in the immune system. *Curr. Biol.* 6: 783-787, 1996.
209. Shen, X., Hu, B., McPhie, P., Wu, X., Fox, A., Germain, R. N., and König, R.: Peptides corresponding to CD4-interacting regions of murine MHC class II molecules modulate immune responses of CD4 $^{+}$ T lymphocytes in vitro and in vivo. *J. Immunol.* 157: 87-100, 1996.
210. Zhong, G., Castellino, F., Romagnoli, P., and Germain, R. N.: Evidence that binding site occupancy is necessary and sufficient for effective major histocompatibility complex class II transport through the secretory pathway redefines the primary function of class II associated invariant chain peptides. *J. Exp. Med.* 184: 1-16, 1996.
211. Huang, L-Y., van Meerwijk, J. P. M., Bikoff, E. K., and Germain, R. N.: Comparison of thymocyte development in normal and invariant chain-deficient mice provides evidence that maturation-related changes in TCR and coreceptor levels play a critical role in cell fate. *Int. Immunol.* 8: 1429-1440, 1996.
212. Germain, R. N., Bikoff, E. K., Bonifacino, J., Castellino, F., Han, R., Marks, M., Romagnoli, P., and Zhong, G.: Invariant chain regulation of MHC class II function in the secretory and endocytic pathways. *Alfred Benzon Symposium*. 40: 1-13, 1996.

Ronald N. Germain, M.D., Ph.D.

213. Madrenas, J., Schwartz, R. H., and Germain, R. N.: IL-2 production, not the pattern of early TCR-dependent tyrosine phosphorylation, controls anergy induction by both agonists and partial agonists. *Proc. Natl. Acad. Sci. (USA)* 93: 9736-9741, 1996.
214. Lucas, B., and Germain, R. N.: Unexpectedly complex regulation of CD4/CD8 coreceptor expression supports a revised model for CD4+CD8+ thymocyte differentiation. *Immunity*. 5:461-477, 1996.
215. Madrenas, J., Chau, L. A., Smith, J., Bluestone, J. A., and Germain, R. N.: The efficiency of CD4 recruitment to ligand-engaged TCR controls the agonist/partial agonist properties of peptide-MHC molecule ligands. *J. Exp. Med.* 185: 1-11, 1997.
216. Zhong, G., Romagnoli, P., and Germain, R. N.: Related leucine-based cytoplasmic targeting signals in invariant chain and major histocompatibility complex class II molecules control endocytic presentation of distinct determinants in a single protein. *J. Exp. Med.* 185: 1-10, 1997.
217. van Meerwijk, J. P. M., Yewdell, J. W., Marguerat, S., Lees, R. K., Germain, R. N., Fowlkes, B. J., and MacDonald, H. R.: Quantitative impact of thymic clonal deletion on the T cell repertoire. *J. Exp. Med.* 185: 377-384, 1997.
218. Porgador, A., Yewdell, J. W., Deng, Y., Bennink, J. R., and Germain, R. N.: Localization, quantitation, and in situ detection of specific peptide-MHC class I complexes using a monoclonal antibody. *Immunity* 6:715-726, 1997.
219. Castellino, F., Zhong, G., and Germain, R. N.: Antigen presentation by MHC class II molecules: invariant chain function, protein trafficking, and the molecular basis of diverse determinant capture. *Human Immunology*, 54:159-169, 1997.
220. Day, P. M., Yewdell, J. W., Porgador, A., Germain, R. N., and Bennink J. R.: Direct delivery of exogenous MHC class I molecule-binding oligopeptides to the endoplasmic reticulum of viable cells. *Proc. Natl. Acad. Sci. (USA)* 94:8064-8069, 1997.
221. Itoh, Y. and Germain, R. N.: Single cell analysis reveals regulated hierarchical TCR signaling thresholds and intraclonal heterogeneity for individual cytokine responses of CD4+ T cells. *J. Exp. Med.*, 186:757-766, 1997.
222. Zhong, G., Reis e Sousa, C. and Germain, R. N.: Antigen-unspecific B cells and lymphoid dendritic cells both show extensive surface expression of processed antigen:MHC class II complexes after soluble protein exposure in vivo or in vitro. *J. Exp. Med.*, 186:673-682, 1997.
223. Germain, R. N.: T-cell signaling: The importance of receptor clustering. *Current Biology*. 7:R640-R644, 1997.
224. Reis e Sousa, C., Hieny, S., Scharton-Kersten, T., Jankovic, D., Charest, H., Germain, R. N., and Sher, A.: *In vivo* microbial stimulation induces rapid CD40 ligand-independent production of Interleukin 12 by dendritic cells and their re-distribution to T cell areas. *J. Exp. Med.*, 186:1819-1829, 1997.
225. Zhong, G., Reis e Sousa, C., and Germain, R. N.: Production, specificity, and functionality

Ronald N. Germain, M.D., Ph.D.

- of monoclonal antibodies to specific peptide: MHC class II complexes formed by active processing of exogenous protein. *Proc. Natl. Acad. Sci. (USA)*, 94:13856-13861, 1997.
226. Combadiere, B., Reis e Sousa, C., Germain, R. N., and Lenardo, M. J.: Selective induction of apoptosis in mature T lymphocytes by variant T cell receptor ligands. *J. Exp. Med.*, 187:349-355, 1998.
227. Steinman, R. M. and Germain, R. N.: Antigen presentation and related immunological aspects of HIV-1 vaccines. *AIDS* 1998, 12(suppl A):S97-S112, 1998.
228. Hemmer, B., Stefanova, I., Vergelli, M., Germain, R.N., and Martin, Roland. : Relationships among T cell receptor ligand potency, thresholds for effector function elicitation, and the quality of early signaling events in human T cells. *J. Immunol* 160:5807-5814, 1998
229. Germain, R. N.: Antigen processing and presentation. *Fundamental Immunology*. 4th Edition. (ed. Paul, W. E.) Raven Press. pp.287-340, 1998.
230. Sant'Angelo, D. B., Lucas, B., Waterbury, P. G., Cohen, B., Brabb, T., Goverman, J., Germain, R. N. and Janeway, C. A., Jr.: A molecular map of T cell development. *Immunity*. 9: 179-186, 1998.
231. Kim, M. G., Chen, C., Flomerfelt, F. A., Germain, R. N. and Schwartz, R. H.: A subtractive PCR-based cDNA library made from fetal thymic stromal cells. *J Immunol Methods*. 213: 169-182, 1998.
232. Porgador, A., Irvine, K. R., Iwasaki, A., Barber, B. H., Restifo, N. P. and Germain, R. N.: Predominant role of directly transfected dendritic cells in antigen presentation to CD8+ T cells after gene gun immunization. *J Exp Med.* 188: 1075-1082, 1998.
233. Castellino, F., Zappacosta, F., Coligan, J. E., and Germain, R. N.: Large protein fragments as substrates for endocytic antigen capture by MHC class II molecules. *J Immunol.* 161: 4048-4057, 1998.
234. Sher, A., Hieny, S., Charest, H., Scharton-Kersten, T., Collazo, C., Germain, R. N., and Reis e Sousa, C.: The role of dendritic cells in the initiation of host resistance to *Toxoplasma gondii*. *Adv Exp Med Biol.* 452: 103-110, 1998.
235. Germain, R. N. and Stefanova, I.: The dynamics of T cell receptor signaling: Complex orchestration and the key roles of tempo and cooperation. *Ann. Rev. Immunol.* 17: 467-522, 1999.
236. Lucas, B., Stefanova, I., Yasutomo, K., Dautigny, N. and Germain, R. N.: Divergent changes in the sensitivity of maturing T cells to structurally related ligands underlies formation of a useful T cell repertoire *Immunity*. 10: 367-376, 1999.
237. Itoh, Y., Hemmer, B., Martin, R. and Germain, R. N.: Serial TCR engagement and down-modulation by peptide:MHC molecule ligands: Relationship to the quality of individual TCR signaling events. *J Immunol.* 162: 2073-2080, 1999.
238. Reis e Sousa, C. and Germain, R. N.: Analysis of adjuvant function by direct visualization of

Ronald N. Germain, M.D., Ph.D.

- antigen presentation In vivo: endotoxin promotes accumulation of antigen- bearing dendritic cells in the T cell areas of lymphoid tissue *J Immunol.* 162: 6552-6561, 1999.
239. Dittel, B. N., Stefanova, I., Germain, R. N. and Janeway, C. A., Jr.: Cross- antagonism of a T cell clone expressing two distinct T cell receptors. *Immunity.* 11: 289-298, 1999.
240. Germain, R. N.: Behind the veils: Uncovering the biology of dendritic cells. *Cell.* 98:719-721, 1999.
241. Inaba, K., Turley, S., Tomonori Iyoda, T., Yamaide, F., Shimoyama, S., Reis e Sousa, C., Germain, R. N., Mellman, I., and Steinman, R. M.: The formation of immunogenic major histocompatibility complex class II-peptide ligands in lysosomal compartments of dendritic cells is regulated by inflammatory stimuli. *J. Exp. Med.* 191: 927-936, 2000.
242. Lu, F. W. M., Yasutomo, K., Goodman, G. B., McHeyzer-Williams, L. J., McHeyzer-Williams, M. G., Germain, R. N., and Ashwell, J. D.: Thymocyte resistance to glucocorticoids leads to antigen-specific unresponsiveness due to “holes” in the T cell repertoire. *Immunity.* 12 : 183-192, 2000.
243. Yasutomo, K., Doyle, C., Miele, L., and Germain, R. N.: The duration of antigen receptor signaling determines CD4+ versus CD8+ T-cell lineage fate. *Nature.* 404: 506-510, 2000.
244. Itoh, Y. and Germain, R. N.: Variant Ligands, altered T-cell receptor signaling, hierarchical response thresholds, and CD4+ effector responses. *Cytokine in Autoimmunity.* (ed. Kuchroo, V. J., Hafler, D. A., and Sarvetnick, N.) Humana Press. Pp. 49-78, 2000.
245. Castellino, F., Boucher, P. E., Eichelberg, K., Mayhew, M., Rothman, J. E., Houghton, A. N., and Germain, R. N.: Receptor-mediated uptake of antigen:HSP complexes results in MHC class I antigen presentation via two distinct processing pathways. *J. Exp. Med.* 191: 1957-1964, 2000.
246. Lucas, B. and Germain, R.N.: Opening a window on thymic positive selection: Developmental changes in the influence of cosignaling by integrins and CD28 on selection events induced by TCR engagement. *J. Immunol.* 165: 1889-1895, 2000.
247. Yasutomo, K., Lucas, B., and Germain, R. N.: TCR signaling for initiation and completion of thymocyte positive selection has distinct requirements for ligand quality and presenting cell type. *J. Immunol.* 165: 3015-3022, 2000.
248. Delon, J. and Germain, R. N.: Information transfer at the immunological synapse. *Curr. Biol.* 10: R923-933, 2000.
249. Dorfman, J. R., Stefanova, I., Yasutomo, K. and Germain, R. N.: CD4+ T cell survival is not directly linked to self-MHC-induced TCR signaling. *Nat. Immunol.* 1: 329-335, 2000.
250. Castellino, F., Han, R. and Germain, R. N.: The transmembrane segment of invariant chain mediates binding to MHC class II molecules in a CLIP-independent manner. *Eur. J. Immunol.* 31: 841-850, 2001.
251. Germain, R. N.: The art of the probable: system control in the adaptive immune system. *Science.* 293: 240-245., 2001.

Ronald N. Germain, M.D., Ph.D.

252. Germain, R. N.: The T-cell receptor for antigen: Signaling and ligand discrimination. *J Biol Chem.* 2: 2, 2001.
253. Dorfman, J. R., Stefanova, I. I., Yasutomo, K. and Germain, R. N.: Response to 'Class II essential for CD4 survival'. *Nat. Immunol.* 2: 136-137, 2001.
254. Delon, J., Kaibuchi, K. and Germain, R. N.: Exclusion of CD43 from the immunological synapse is mediated by phosphorylation-regulated relocation of the cytoskeletal adaptor moesin. *Immunity.* 15: 691-701, 2001.
255. Germain, R. N. and Harding, C. V.: Editorial overview. *Curr. Opin. Immunol.* 14: 13-14, 2002.
256. Dorfman, J. R. and Germain, R. N.: MHC-dependent survival of naïve T cells? A complicated answer to a simple question. *Microbes and Infection.* 4: 547-554, 2002.
257. Germain, R. N.: T cell development and the CD4/CD8 lineage decision. *Nature Reviews Immunology* 2: 309-322, 2002.
258. Stoll, S., Delon, J., Brotz, T. M. and Germain, R. N.: Dynamic imaging of T cell-dendritic cell interactions in lymph nodes. *Science* 296: 1873-1876, 2002.
259. Germain, R. N.: Two hats too many. *Curr. Biol.* 12: R376, 2002.
260. Stefanova, I., Dorfman, J. R., and Germain, R. N.: Self-recognition promotes the foreign antigen sensitivity of naïve T lymphocytes. *Nature* 420: 429-434, 2002.
261. Delon, J., Stoll, S., and Germain, R. N.: Imaging of T-cell interactions with antigen presenting cells in culture and in intact lymphoid tissue. *Immunol. Rev.* 189: 51-63, 2002.
262. Scheinecker, C., McHugh, R., Shevach, E. M., and Germain, R. N.: Constitutive presentation of a natural tissue autoantigen exclusively by dendritic cells in the draining lymph node. *J. Exp. Med.* 196: 1079-1090, 2002.
263. Germain, R. N., Stefanova, I., and Dorfman, J.: Self-recognition and the regulation of CD4+ T cell survival. *Adv. Exp. Med. Biol.* 5211: 97-105, 2002.
264. Stefanova, I., Dorfman, J. R., Tsukamoto, M., and Germain, R. N.: On the role of self-recognition in T-cell responses to foreign antigen. *Immunol. Rev.* 191: 97-106, 2003.
265. Stefanova, I., Hemmer, B., Vergelli, M., Martin, R., Biddison, W. E., and Germain, R. N.: TCR ligand discrimination is enforced by competing ERK positive and SHP-1 negative feedback pathways. *Nat. Immunol.* 4: 248-254, 2003.
266. Germain, R. N.: T-cell activation: the power of one. *Curr. Biol.* 13: R137-R139, 2003.
267. Mackey, M. F., Wang, Z., Eichelberg, K., and Germain, R. N. Distinct contributions of different CD40 TRAF binding sites to CD145-induced dendritic cell maturation and IL-12 secretion. *Eur. J. Immunol.* 33: 779-789, 2003.
268. Fowlkes, B. J., Germain, R. N., Leonard, W. J., Paul, W. E., and Samelson, L. E.:

Ronald N. Germain, M.D., Ph.D.

- Casting a wider net. *Immunity* 18: 313, 2003.
269. Paul, W. E. and Germain, R. N.: Obituary: Charles A. Janeway Jr. (1943-2003). *Nature* 423: 237, 2003.
270. Germain, R. N.: Ligand-dependent regulation of T cell development and activation. *Immunol. Res.* 27: 277-286, 2003.
271. Germain, R. N.: Immunological techniques. *Curr. Opin. Immunol.* 15: 363-365, 2003.
272. Faure, S., Salazar-Fontana, L. I., Semichon, M., Tybulewicz, V. L., Bismuth, G., Trautmann, A., Germain, R. N., and Delon, J.: ERM proteins regulate cytoskeleton relaxation promoting T cell-APC conjugation. *Nat. Immunol.* 5: 272-279, 2004.
273. Germain, R.N., and Jenkins, M.K.: In vivo antigen presentation. *Curr. Opin. Immunol.* 16: 120-125, 2004.
274. Huang, A. Y., Qi, H. and Germain, R. N.: Illuminating the landscape of in vivo immunity: insights from dynamic in situ imaging of secondary lymphoid tissues. *Immunity* 21:331-339, 2004.
275. Germain, R.N.: An innately interesting decade of research in immunology. *Nat. Med.* 10:1307-20, 2004.
276. Itoh, Y., Wang, Z., Ishida, H., Eichelberg, K., Fujimoto, N., Makino, J., Ogasawara, K. and Germain, R.N.: Decreased CD4 expression by polarized T helper 2 cells contributes to suboptimal TCR-induced phosphorylation and reduced Ca(2+) signaling. *Eur. J. Immunol.* 35: 3187-3195, 2005.
277. Altan-Bonnet, G., and Germain, R.N.: Modeling T cell antigen discrimination based on feedback control of digital ERK responses. *PLoS Biology* 3:e356, 2005.
278. Germain, R.N., Castellino, F., Chieppa, M., Egen, J.G., Huang, A.Y., Koo, L.Y. and Qi, H.: An extended vision for dynamic high-resolution intravital immune imaging. *Semin. Immunol.* 17:431-441, 2005.
279. Germain, R.N.: Imaging dynamic interactions in immune responses. *Semin. Immunol.* 17:385-6, 2005.
280. Bajénoff, M., Breart, B., Huang, A. Y. C., Qi, H., Cazareth, J., Braud, V.M., Germain, R.N., and Glaichenhaus, N.: NK cell behavior in lymph nodes revealed by static and real time imaging. *J. Exp. Med.* 203:619-631, 2006.
281. Benoist, C., Germain, R.N., and Mathis, D.: A *Plaidoyer* for “Systems Immunology”. *Immunol. Rev.* 210:229-34, 2006.
282. Castellino, F., Huang, A.Y.C., Altan -Bonnet, G., Stoll, S., Scheinecker, C., and Germain, R.N.: Chemokines enhance immunity by guiding naive CD8⁺ T cells to sites of CD4⁺ T cell-dendritic interaction. *Nature*. 440:890-5, 2006.

Ronald N. Germain, M.D., Ph.D.

283. Castellino, F. and Germain, R.N.: Cooperation between CD4(+) and CD8(+) T cells: When, where, and how. *Annu. Rev. Immunol.*. 24:519-40, 2006.
284. Qi, H., Egen, J.G., Huang, A.Y., and Germain, R.N.: Extrafollicular activation of lymph node B cells by antigen-bearing dendritic cells. *Science* 312:1672-6, 2006.
285. Meier-Schellersheim, M., Xu, X., Angermann, B., Kunkel, E. J., Jin, T., and Germain, R. N. Key role of local regulation in chemosensing revealed by a new molecular interaction-based modeling method. *PLoS Computational Biol.* 2:e82, 2006.
286. Germain, R. N., Miller, M. J., Dustin, M. L., and Nussenzweig, M, C. Dynamic imaging of the immune system: progress, pitfalls and promise. *Nat. Rev. Immunol.* 6:497-507, 2006.
287. Bajenoff, M., Egen, J. G., Koo, L. Y., Laugier, J. P., Brau, F., Glaichenhaus, N., and Germain, R.N. Stromal cell networks regulate lymphocyte entry, migration, and territoriality in lymph nodes. *Immunity* 25:989-1001, 2006.
288. Chieppa, M., Rescigno, M., Huang, A. Y., and Germain, R. N.: Dynamic imaging of dendritic cell extension into the small bowel lumen in response to epithelial TLR engagement. *J. Exp. Med.* 203:2841-2851, 2006.
289. Castellino, F. and Germain, R.N.: Chemokine-guided CD4+ T cell help enhances generation of IL-6R α high IL-7R α high prememory CD8+ T cells. *J. Immunol.* 178:778-87, 2007.
290. Guarda, G., Hons, M., Soriano, S.F., Huang, A.Y., Polley, R., Martin-Fontecha, A., Stein, J.V., Germain, R.N., Lanzavecchia, A., and Sallusto, F.: L-selectin-negative CCR7- effector and memory CD8+ T cells enter reactive lymph nodes and kill dendritic cells. *Nat Immunol.* 8:743-52, 2007.
291. Bajenoff, M., Egen, J.G., Qi, H., Huang, A.Y., Castellino, F., and Germain, R.N.: Highways, byways and breadcrumbs: directing lymphocyte traffic in the lymph node. *Trends Immunol.* 28:346-352, 2007.
292. Feinerman, O., Germain, R.N., and Altan-Bonnet, G.: Quantitative challenges in understanding ligand discrimination by $\alpha\beta$ T cells. *Mol Immunol.* 45:619-31, 2008.
293. Bajenoff, M. and Germain, R.N.: Seeing is believing: A focus on the contribution of microscopic imaging to our understanding of immune system function. *Eur. J. Immunol.* 37(S1):18-33, 2007.
294. Egen, J.G., Rothfuchs, A. G., Feng, C.G., Winter, N., Sher, A., and Germain, R.N.: Macrophage and T cell dynamics during the development and disintegration of mycobacterial granulomas. *Immunity* 28: 271-284, 2007.
- 295: Germain, R. N.: Special regulatory T-cell review: A rose by any other name: from suppressor T cells to Tregs, approbation to unbridled enthusiasm. *Immunology* 123: 20-27, 2008.
296. Germain, R. N., Bajenoff, M., Castellino, F., Chieppa, M., Egen, J. G., Huang, A. Y., Ishii, M., Koo, L. Y., and Qi, H.: Making friends in out-of-the-way places: How cells of the immune system get together and how they conduct their business as revealed by intravital imaging.

Ronald N. Germain, M.D., Ph.D.

- Immunol. Rev.* 221: 163-181, 2008.
- 297. O’Shea, J., Hunter, C., and Germain, R. N.: T cell heterogeneity: firmly fixed, predominantly plastic or merely malleable? *Nat. Immunol.* 9:450-3, 2008.
 - 298. Peters, N.C.* , Egen, J.G.* , Secundino, N., Debrabant, A., Kimblin, N., Kamhawi, S., Lawyer, P., Fay, M.P., Germain, R.N.* , and Sacks, D.*: Neutrophil dependency during vector transmission of Leishmania, revealed by in vivo imaging. *Science*, 321:970-4, 2008.
 - 299. Feinerman, O.* , Veiga, J.* , Dorfman, J.R., Germain, R.N., and Altan-Bonnet, G. Variability and robustness in T cell activation from regulated heterogeneity in protein levels. *Science*, 321:1081-4, 2008.
 - 300. Qi, H.* , Cannons, J.* , Schwartzberg, P.* , and Germain, R.N.* SAP-controlled T-B interactions underlie the formation of germinal centres. *Nature*, 455:764-9, 2008.
 - 301. Bajénoff, M., Glaichenhaus, N., and Germain, R.N. Fibroblastic reticular cells guide T lymphocyte entry into and migration within the splenic T cell zone. *J. Immunol.* 181:3947-3954, 2008.
 - 302. Ishii, M., Egen, J.G., Klauschen, F., Meier-Schellersheim, M., Saeki, Y., Vacher, J., Proia. R.L., and Germain, R.N. Sphingosine-1-phosphate mobilizes osteoclast precursors and regulates bone homeostasis. *Nature*, 458:524-8, 2009.
 - 303. Fraser, I.D. and Germain, R.N. Navigating the network: signaling cross-talk in hematopoietic cells. *Nat. Immunol.* 10:327-31, 2009.
 - 304. Hammad, H., Chieppa, M., Perros, F., Willart, M.A., Germain, R.N., and Lambrecht, B.N. House dust mite allergen induces asthma via Toll-like receptor 4 triggering of airway structural cells. *Nat. Med.* 15:410-6, 2009.
 - 305. Klauschen, F., Qi, H., Egen, J.G., Germain, R.N., and Meier-Schellersheim, M. Computational reconstruction of cell and tissue surfaces for modeling and data analysis. *Nat. Protoc.* 4:1006-12, 2009.
 - 306. Mueller, S.N. and Germain, R.N. Stromal cell contributions to the homeostasis and functionality of the immune system. *Nat. Rev. Immunol.* 9:618-629, 2009.
 - 307. Klauschen, F., Ishii, M., Qi, H., Bajénoff, M., Egen, J.G., Germain, R.N., and Meier-Schellersheim, M. Quantifying cellular interaction dynamics in 3D fluorescence microscopy data. *Nat. Protoc.* 4:1305-11, 2009.
 - 308. Bajénoff, M. and Germain, R.N. B cell follicle development remodels the conduit system and allows soluble antigen delivery to follicular dendritic cells. *Blood*, 114: 4989-4997, 2009.
 - 309. Mazzucchelli, R.I., Warming, S., Lawrence, S.M., Ishii, M., Abshari, M., Washington, A.V., Feigenbaum, L., Warner, A.C., Sims, D.J., Li, W.Q., Hixon, J.A., Gray, D.H., Rich, B.E., Morrow, M., Anver, M.R., Cherry, J., Naf, D., Sternberg, L.R., McVicar, D.W., Farr, A.G., Germain, R.N., Rogers, K., Jenkins, N.A., Copeland, N.G., and Durum, S.K. Visualization and identification of IL-7 producing cells in reporter mice. *PLoS One* 4:e7637, 2009.

Ronald N. Germain, M.D., Ph.D.

310. Vrisekoop, N., Mandi, J. N., and Germain, R. N.: Life and death as a T lymphocyte: from immune protection to HIV pathogenesis. *J. Biol.* 8: 91, 2009 (a review)
311. Cannons, J.L., Qi, H., Lu, K.T., Ghai, M., Gomez-Rodriguez, J., Cheng, J., Wakeland, E.K., Germain, R.N., and Schwartzberg, P.L. Optimal germinal center responses require a multi-stage T:B cell adhesion process involving integrins, SAP and CD84. *Immunity*, 32: 253-265, 2010.
312. Coward, J., Germain, R. N., and Altan-Bonnet, G.: Perspectives for computer modeling in the study of T cell activation. *Cold Spring Harb. Perspect. Biol.* Immunoreceptor Signaling, Ed. by L.E. Samelson and A. Shaw, pp. 261-276, 2010.
313. Kastenmüller, W., Gerner, M.Y., and Germain, R.N.: The in situ dynamics of dendritic cell interactions. *Eur J Immunol.* 40: 2103-6, 2010.
314. Germain, R. N.: Computational analysis of T cell receptor signaling and ligand discrimination. *FEBS Letters* 584: 4814-4822, 2010.
315. Germain, R. N.: Vaccines and the future of human immunology. *Immunity* 33: 441-450, 2010.
316. Ishii, M., Kikuta, J., Shimazu, Y., Meier-Schellersheim, M., and Germain, R.N. Chemorepulsion by blood S1P regulates osteoclast precursor mobilization and bone remodeling in vivo. *J Exp Med.* 207: 2793-2798, 2010.
317. Bumb, A., Regino, C.A., Egen, J.G., Bernardo, M., Dobson, P.J., Germain, R.N., Choyke, P.L., and Brechbiel, M.W., Trafficking of a dual-modality magnetic resonance and fluorescence imaging superparamagnetic iron oxide-based nanoprobe to lymph nodes. *Mol Imaging Biol.* 13:1163-1172.
318. Germain, R.N., Meier-Schellersheim, M., Nita-Lazar, A., and Fraser, I.D., Systems biology in immunology: A computational modeling perspective, *Ann. Rev. Immunol.* 29:527-85, 2011.
319. Germain, R.N. and Schwartzberg, P.L., The human condition: an immunological perspective. *Nat Immunol.* 12:369-72, 2011.
320. Egen, J.G., Rothfuchs, A.G., Feng, C.G., Horwitz, M.A., Sher, A., and Germain, R.N., Intravital imaging reveals limited antigen presentation and T cell effector function in mycobacterial granulomas. *Immunity*. 34:807-19, 2011.
321. Kastenmüller, K., Wille-Reece, U., Lindsay, R.W., Trager, L.R., Darrah, P.A., Flynn, B.J., Becker, M.R., Udey, M.C., Clausen, B.E., Iggyarto, B.Z., Kaplan, D.H., Kastenmüller, W., Germain, R.N., and Seder, R.A. Protective T cell immunity in mice following protein-TLR7/8 agonist-conjugate immunization requires aggregation, type I IFN, and multiple DC subsets. *J Clin Invest.* 121:1782-96, 2011.
322. Germain, R.N. Uncovering the Role of Invariant Chain in Controlling MHC Class II Antigen

Ronald N. Germain, M.D., Ph.D.

- Capture. Germain RN. *J Immunol*. 187:1073-5, 2011.
323. Mionnet, C., Sanos, S.L., Mondor, I., Jorquera, A., Laugier, J.P., Germain, R.N., and Bajénoff, M. High endothelial venules as traffic control points maintaining lymphocyte population homeostasis in lymph nodes. *Blood*. 118:6115-22, 2011.
324. Germain, R.N. and Paul, W.E. Baruj Benacerraf (1920-2011). Obituary. *Nature*. 477:34, 2011.
325. Germain, R.N. and Burakoff, S.J. A remembrance of Baruj Benacerraf (AAI '57) 1920-2011. *J Immunol*. 187:5465-9, 2011.
326. Kastenmuller,W., Gasteiger, G., Subramanian, N., Sparwasser, T., Busch, D.H., Belkaid, Y., Drexler, I., and Germain, R.N. Regulatory T cells selectively control CD8+ T cell effector pool size via IL-2 restriction. *J Immunol*. 187:3186-97, 2011.
327. Angermann, B.R., Klauschen, F., Garcia, A.D., Prustel, T. Zhang, F., Germain, R.N., and Meier-Schellersheim, M. Computational modeling of cellular signaling processes embedded into dynamic spatial contexts. *Nat Methods*. 9:283-9, 2012.
328. Gaiser, M.R., Lämmermann, T., Feng, X., Iggyarto, B.Z., Kaplan, D.H., Tessarollo. L., Germain, R.N., and Udey, M.C. Cancer-associated epithelial cell adhesion molecule (EpCAM; CD326) enables epidermal Langerhans cell motility and migration in vivo. *Proc Natl Acad Sci U S A*. 109:E889-97, 2012.
329. Tang, J., Germain, R.N., and Cui, M. Superpenetration optical microscopy by iterative multiphoton adaptive compensation technique. *Proc Natl Acad Sci U S A*. 109:8434-9, 2012.
330. Germain, R.N., Robey, E.A., and Cahalan, M.D. A decade of imaging cellular motility and interaction dynamics in the immune system. *Science*. 336:1676-81, 2012.
331. Lee, M., Mandl, J.N., Germain, R.N., and Yates, A.J. The race for the prize: T cell trafficking strategies for optimal surveillance. *Blood*. 120:1432-1438, 2012.
332. Gerner, M.Y., Kastenmuller, W., Ifrim, I., Kabat, J., and Germain, R.N. Histo-Cytometry: A method for highly multiplex quantitative tissue imaging analysis applied to dendritic cell subset microanatomy in lymph nodes. *Immunity*. 37:364-376, 2012.
333. Petrovas, C., Yamamoto, T., Gerner, M.Y., Boswell, K.L., Wloka, K., Smith, E.C., Ambrozak, D.R., Sandler, N.G., Timmer, K.J., Sun, X., Pan, L., Poholek, A., Rao, S.S., Brenchley, J.M., Alam, S.M., Tomaras, G.D., Roederer, M., Douek, D.C., Seder, R.A., Germain, R.N., Haddad, E.K., and Koup R.A. CD4 T follicular helper cell dynamics during SIV infection. *J Clin Invest*. 122:3281-3294, 2012.
334. Kastenmüller, W., Torabi-Parizi, P., Subramanian, N., Lämmermann, T. and Germain, R.N. A spatially-organized multicellular innate immune response in lymph nodes limits systemic pathogen spread. *Cell*. 150:1235-1248, 2012.
335. Lee, G-S., Subramanian, N., Kim, A., Aksentijevich, I., Goldbach-Mansky, R., Sacks, D.B., Germain, R.N., Kastner, D.L. and Chae, J. The calcium sensing receptor controls NLRP3

Ronald N. Germain, M.D., Ph.D.

- inflammasome activation through intracellular Ca²⁺ and cAMP. *Nature*. In press, 2012.
336. Germain, R.N. Maintaining system homeostasis: the third law of Newtonian immunology. *Nat Immunol*. 13:902-6, 2012.
337. Mandl, J.N., Liou, R., Klauchen, F., Vrisekoop, N., Monteiro, J.P., Huang, A. Y., and Germain, R.N. Quantification of lymph node transit times reveals differences in antigen surveillance strategies of naïve CD4+ and CD8+ T cells. *Proc Natl Acad Sci U S A*. 109:18036-18041, 2012.
338. Gottschalk, R.A., Martins, A.J., Sjoelund, V., Angermann,, B.R., Lin, B. and Germain, R.N. Recent progress using systems biology to better understand molecular mechanisms of immunity. *Sem. Immunol*. In press, 2012.